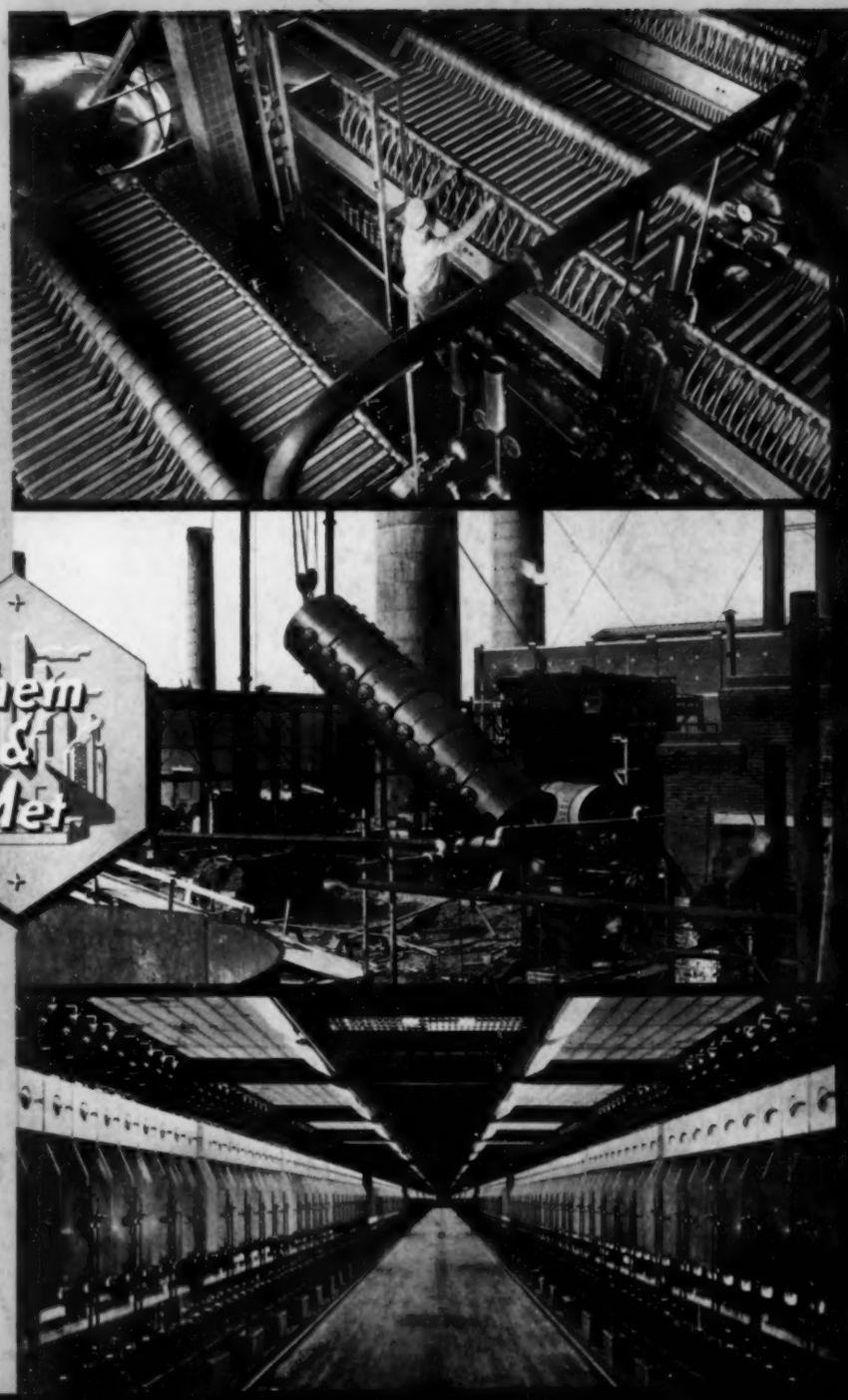
CHEMICAL & METALLURGICAL ENGINEERING



JULY, 1942

CHEMICAL ENGINEERS HELP TO BREW GOOD BEER

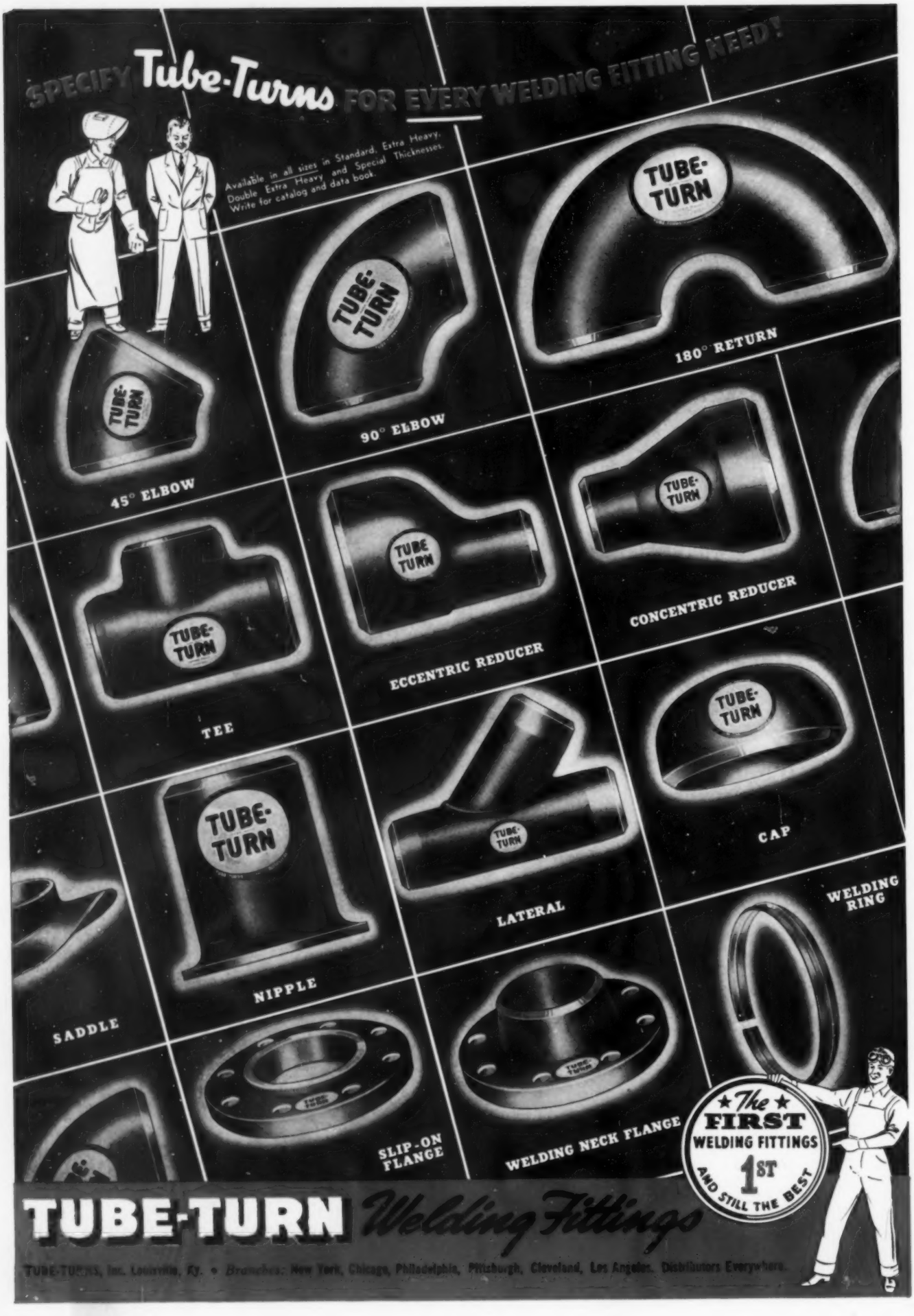
From grain to glass the brewing art depends on unit operations and equipment of the chemical process industries. These huge filter presses are typical of the modern facilities of one of New York's oldest and largest breweries. See pp. 112-5 for other pictures and flowsheet of lager beer production.

WAR-TIME CONSTRUCTION IN CHEMICAL INDUSTRIES

Industries undertaking war work must get the job done in spite of hell, high water and red tape. New plant construction when absolutely essential must be pushed ahead regardless of obstacles. This month's report on pp. 99 to 106 suggests many helpful procedures and short cuts in getting such work underway.

GETTING LONGER LIFE FOR ALUMINUM EQUIPMENT

Now that most aluminum goes to war uses it behooves us to apply proper protective measures in those equipment applications where severe conditions might cause dangerous corrosion. These dryer boxes in an Ohio rayon plant are being given such attention. Read pp. 86 to 89 for other suggestions.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Chem & Met

NEXT MONTH

Every week is Fire Prevention Week in the chemical process industries. Particularly now must we tighten our defenses against fire and provide special precautions to guard against the arsonist and the saboteur. Fire and explosion hazards have multiplied as a result of expanding operations into new fields with less experienced personnel, all pushed by the tremendous urge for faster and faster production. So next month *Chem. & Met.* will tackle the problem of providing its readers with practical data and worthwhile experience gleaned from the field of fire prevention—a timely subject for the year's hottest month!

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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 S. D. KIRKPATRICK, *Editor*

JULY, 1942

MILESTONES AND CORNERSTONES

FIFTY YEARS AGO our good dean of chemical engineering educators, Professor Alfred Holmes White of Michigan, was told by his teachers that the field of physics was practically closed. "The best you can look forward to, young man, is the opportunity to redetermine certain physical constants with a little greater accuracy — perhaps changing the fourth decimal place." Yet today, in a very real sense, this is the war of the physicists. The military decisions that may yet change the whole history of mankind for a fourth generation to come are now being born in the research laboratories of American universities and technological institutions.

The occasion of Colonel White's remarks was in Evanston, Ill. on June 15, when, as president of the Society for the Promotion of Engineering Education, he represented the profession at the dedication of the new Technological Institute of Northwestern University. Other distinguished engineers, scientists and educators shared the limelight with political leaders of the state and nation and with men like Donald Nelson and General Knudsen, who recognized in this event another step in the mobilization of science and engineering in the present national emergency.

The dedication could scarcely have come at a more appropriate time to emphasize the importance of our technological educational institutions to the welfare and safety of our country. President Karl T. Compton of M.I.T., whose address dealt with the future of engineering education, digressed long enough to note that the Office of Scientific Research and Development has already entered into 663 contracts with educational institutions for the performance of research and development work with but one objective—to improve our war effort. He could not even hint at the nature of the investigations "that have already shown promise of becoming important factors in the forthcoming military decision."

Closely paralleling the war work in the universities is that in the industrial research laboratories, where more than 200 contracts have been placed with about 75 commercial firms. To our knowledge, one company with a $5,000,000 research and development budget is today devoting 90 percent of its energies to the Victory effort, but, of course, only a small part of this is on direct OSRD contact. Such is the change from that first industrial research laboratory in the United States which Dr. Compton told us was established in 1834 by the Merrimack Manufacturing Co. in Lowell, Mass. and had as its objective the study of the chemistry of cow dung and of substitutes for cow dung as chemicals used in calico dyeing. Today that laboratory's modern successor is working on more offensive agents of chemical warfare and there is no "e" in the kind of "dying" with which it is now concerned!

Chemical engineering received a high tribute from President Compton when he remarked that "future improvements in engineering education may be expected to follow along a path which has been laid out by the chemical engineers." He traced the change from the earlier method of studying the details of a diversity of manufacturing processes to the modern approach through an integrated conception of fundamental unit operations. "This new concept . . . has resulted in chemical engineering's becoming one of the most useful and active of all engineering professional fields. The students in this program develop a power to handle situations rather than to absorb a mass of detail applicable only to appropriate specific situations."

Dr. George O. Curme, Jr., of Northwestern's class of 1909, saw in the new Technological Institute an important parallel with "Research in Industry," which was the title of his address. Today research squads are used like task forces in which all types of talents and weapons are combined to reach the desired objective. The tremendous physical plant of the Institute, providing ten acres of floor area in a building 500 ft. wide and 342 ft. deep, brings the departments of chemistry and

physics into close association with the four major branches of engineering—chemical, civil, electrical and mechanical. Dr. Curme feels that this closer, mutually stimulating cooperation can open up new frontiers far beyond the present horizons of research.

Both the Hon. Jesse Jones and the equally honorable Donald Nelson stressed the importance of the new facilities in relation to the post-war world. The Secretary of Commerce said that "those who will pass through the Technological Institute of Northwestern, benefitting from both theoretical and practical knowledge, can contribute much when the day for peace-time conversion comes." Nelson said, "We need and must have engineers, not only to speed up the war program, but to aid us with the great task which will be ours when peace comes, as come it will. We are going to need engineers to mobilize for peace with the same enthusiasm, energy and determination that we are mobilizing for war. Now, and in the future, within the walls of this Institute and outside it in the laboratories and factories of industry, there can be no faltering in the continuous search for ways of achieving greater and greater results for mankind."

Such were the highlights in dedicating a great new facility for technological education. In a broader sense it was a dedication of all technology and of all its practitioners to a new and greater spirit of service to the nation and to the cause of human liberty throughout the world.

AGAINST THE PUBLIC INTEREST

INDICTMENTS have been returned at South Bend, Indiana, against numerous chemical companies and their executives. It is not yet proper here to comment on the guilt or innocence of the defendants so brought to bar. But it is appropriate, in fact we believe it important, to point out that the action of the Department of Justice in these proceedings has no justification, because it is very definitely contrary to the public interest.

The Department of Justice has appropriately from time to time investigated the basis on which chemicals are marketed. It is the duty of that Department to see that the law regarding restraint of trade is in force. Under all ordinary conditions there should be prosecutions when there seems to be valid evidence of serious violation of the law. So much for normal conditions.

Present conditions are very different. In the first place, the Department itself has been doing a slovenly job by bringing up cases which Federal judges have thrown out without defense because no proof of guilt was submitted. In the second place, there is evidence in the writings of Assistant Attorney General Arnold himself that it is his purpose to accomplish reform by means of these Court prosecutions. In the third place, even the Department of Justice ought to be busy at jobs which help win the war; certainly they should not take time from far more urgent jobs of their own. Nor should they be permitted to take thousands of mandays of useful war effort away from chemical companies to defend themselves against such attacks.

In due time we shall find out what the Courts say about the recent indictments. But in the meantime, it is safe to conclude that the Department of Justice's activities while perhaps technically and legally proper, are dangerously close to treason. They are in effect equal to the taking of thousands of soldiers away from the fighting front in order to meet trumped-up traffic charges for speeding alleged to have happened months ago.

It seems high time that President Roosevelt should take charge of this situation and correct it. This can be done without any sacrifice of the Department's right to enforce the law, a right which is also its duty.

THAT LONGER LOOK AHEAD

ONE of the greatest obstacles to date in the whole war-time construction program has been the uncertainty as to requirements. Some chemical companies were alert enough to see the need and get ready for them. In days when priorities were not so difficult to obtain, a few organizations built plants a little beyond official requirements and are now able to do a better job because of that happy foresight. Unfortunately those are exceptions. Too often capacities were established and approved when those in the government responsible for supplies knew that actual requirements far exceeded the official figures. Nevertheless, there must be no complaining. It is industry's job to do its utmost to prepare itself to produce what in fact will be needed to sustain our war effort.

An executive of a leading chemical company writes us as follows:

> "With the very serious reduction of raw material supplies entering this country following the attack on Pearl Harbor and the continued prosecution of German submarine attacks on our shipping, it becomes increasingly evident that within a year's time, we will need extensive expansion of some of our chemical industries in order to fill the gap caused by the growing scarcity of natural raw materials.
>
> In spite of this rather obvious situation which is developing, I know of no effort being made by our government to forecast this condition and to provide for it by expanding chemical plants other than those that some day will make our synthetic rubber. No country-wide survey has been made to estimate the essential requirements for substitutes that will soon be very badly needed. Even our Navy is rushing around trying to find substitutes for materials which have been taken away from them while in the meantime the enemy's submarines continue to sink our supplies of other materials which might have been used as substitutes for the substitutes. There is need for some agency, governmental or private, to make a thorough-going study of the needs for chemical substitute materials, to take the place of natural materials no longer available in this country."

This has an important bearing, too, on the problem of providing new plant capacity in the chemical process industries—a subject which is reviewed

at some length in the current Chem. & Met. Report on War-Time Construction. (See pp. 99 to 106 of this issue.) We have now got to fight for such new facilities as are absolutely essential to keep the war program rolling.

ON THE POLITICAL FRONT

MANY observers of Washington have lately pointed out that the desire for reelection is occasioning some highly undesirable delays in legislative action. Politics are affecting many decisions on war policies that ought to be made strictly on merit. The unwillingness to vote promptly on a tax bill, the unwillingness to give the Army more of the young men of 19 to 20 years of age, and the other postponements of embarrassing votes until after November, are the kind of criticisms commonly cited. Those who have influence with members of Congress may to some small degree offset these tendencies for delay. They can emphasize to these members that aggressive patriotic effort is the best kind of politics today. Facing unpleasant votes frankly ought to be made the finest argument for reelection. In a few cases it may be.

WASHINGTON HIGHLIGHTS

COMPETENT ENGINEERS in the top organization of both the War Manpower Commission and the Army Specialists Corps understand the technical personnel problems of industry. Likewise they know that the Army needs engineers in industry just as badly as it needs competent military personnel in uniform. This is encouraging. We cannot expect that all diversions of much needed men from civilian posts to non-technical Army jobs can be stopped at once. But we can hope that the recent trend of taking too large a number of key personnel will be reversed. Those who will establish the guiding principles here are Dr. William O. Hotchkiss, Deputy Director General, Army Specialists Corps, on leave as president of Rensselaer Polytechnic Institute, and Dr. Edward C. Elliott of the War Manpower Commission, president of Purdue University.

DEFERMENT of key employees must be requested by employers. Washington does not think it is in the public interest for management to be unwilling to carry through aggressively its arguments for deferment when highly skilled personnel is likely to be drafted for military service in which that skill is less essential. It is one thing to provide a hideout for slackers; it is an entirely different thing to decline to make necessary and urgent requests for deferment of essential personnel. Management has a real responsibility in this matter.

PRICE RISES start on the farm. In the first four months of 1942, the sales of farm goods returned 50 percent more dollars to farmers than in the corresponding period a year ago. Processors feel very sharply the pinch between a frozen price ceiling and these rising costs of both raw materials and labor. No amount of increased business helps much in these circumstances.

T.V.A. has had another reprieve. Congress seriously considered limiting its disbursements to the actual appropriations but it was evident that the corporate activities of this quasi-government body would thus be severely restricted. Hence the use of revolving funds has been continued. But the attack on T.V.A., which was by no means the last one to be expected, shows that Congress does not like to relinquish the administrative control of funds, even when there is no question as to the desirability of the spending.

RAILROAD CAR MOVEMENT must be speeded. Every plant management must, and it is a real MUST, arrange for prompt loading of cars when spotted on their sidings and immediate unloading of deliveries. Any establishment failing to cooperate promptly is likely to be deprived of car service.

RECRIMINATION runs in cycles. After each military set-back there is a new wave of criticism. The loss of Libya occasioned one of the most bitter uprisings of everyone against everybody else in the Capitol. This is democratic human nature in action. If it does not destroy too much of the enthusiasm for support of war undertaking, it is a good symptom.

SPENDING something over fifty billion dollars next year by the Army, Navy and Lease-Lend agencies in military effort will depend primarily on a single factor—availability of essential raw materials, primarily metals and chemicals. Hence there must be, first, a maximum production of every wanted commodity and, second, a rigorous conservation to stretch limited supplies over the maximum possible essential service.

GAS WARFARE is expected. The warning of the President that the United States will retaliate if Japan persists in using toxic chemicals on the Chinese was more than a gesture. Definite preparation is being made. Chemical Warfare Service is establishing a huge new training center where it will prepare both defense and offense personnel for this kind of fighting. America does not wish it, but does not intend to remain unprepared.

SHORTAGES of three things most worry Washington. (1) We have nothing like as much metal to cut up into implements of war as we could use effectively with present manpower and present plant capacity. (2) Even present production cannot be moved promptly to the fighting fronts because of shortage of ships. (3) Lack of rubber threatens to force civilian activities below what is regarded as a minimum essential level, even for war-time. Many decisions of official Washington that otherwise cannot be understood root in these three worries.

PLANS of the new special Rubber Investigation of the House of Representatives were pretty well forecast by its newly appointed counsel, Elliot E. Simpson. Among other things, this gentleman stated frankly that he will try "to prove conclusively that America can supply more than enough rubber for all military and civilian needs." Judging from such preconceived conclusions, another political pillaging of industry is in the offing.

Production of Acetylene by Thermal Cracking of Petroleum Hydrocarbons

R. LEONARD HASCHE *Tennessee Eastman Corp., Kingsport, Tennessee*

Chem. & Met. INTERPRETATION

In common with most chemicals and chemical raw materials, acetylene is becoming increasingly important in America's Victory program. Pyrolysis of hydrocarbons has long been recognized as a potential source of the gas, but technical difficulties have heretofore ruled out commercial installations. How these were overcome is related here by one of the men largely responsible for the success of a project to make cracking a practical source of acetylene.—*Editors.*

ACETYLENE has long been recognized as one of the most important and versatile starting materials for organic syntheses, particularly for the preparation of aliphatic compounds. Although its reactivity with a great variety of substances was early recognized and made use of by the chemist in the laboratory, only within comparatively recent years has it been applied to commercial syntheses. The first important development in this direction was the conversion of acetylene, obtained from calcium carbide, to acetaldehyde as the first step in the production of acetic acid. This industry has now assumed very large proportions both in this country and abroad. Some of the newer chemicals now being manufactured from acetylene are vinyl acetylene, vinyl acetate and the halogen derivatives —tetrachlorethane and trichlorethylene.

A much larger field of usage for acetylene is now opening up in the manufacture of butadiene for synthetic rubber. In Germany, coincident with the development of a self-sufficiency in synthetic rubber, the construction of calcium carbide plants was stepped up several-fold. While in this country the petroleum industry offers possibilities of producing butadiene by cracking, there seems little doubt that acetylene will be a formidable competitor, due to both low cost and the purity of the butadiene obtainable by this method. We have mentioned vinyl acetylene as another product which is an intermediate in the preparation of the chloroprene rubbers. Thus, we see that acetylene is destined to play an important role in our National Victory Program.

ADVANTAGES OF THERMAL CRACKING

Let us consider the factors that recommend the thermal cracking method for the commercial production of acetylene. One obvious advantage of straight thermal pyrolysis of hydrocarbons to produce acetylene over the electric arc or silent discharge is that the necessary heat can be supplied by burning the byproduct gases, produced in the process, which consist mainly of hydrogen and methane. In other words, the cost of energy for the pyrolysis is included in the cost of the hydrocarbon material processed. The net saving of the thermal over the electrical method—with equal yields of acetylene—is the cost of the electrical power required in the latter method. At a cost of three mills per kwh. this saving would amount to about 1¼c. per lb. of acetylene, a substantial proportion of the total cost.

Another very important advantage following logically from the above pyrolysis of hydrocarbons as a competitor for calcium carbide warrants careful consideration. This is particularly true now due to the threatened shortage of electric power as a result of the demands of the Defense Program in the production of aluminum and magnesium. Power is the largest single item of cost in calcium carbide manufacture, amounting to approximately 3,000 kwh. per ton or equivalent to about 4.5 kwh. per lb. of acetylene.

ELECTRICAL CRACKING

Acetylene is a very endothermic compound, having a heat of formation from its elements of about 59,000 cal. In order to produce it from a hydrocarbon richer in hydrogen, temperatures above 1,100 deg. C. are required. For hydrocarbons higher than methane, employing contact times of about 0.1 sec., optimum yields of acetylene require temperatures of approximately 1,225 deg. C., and for methane itself in the neighborhood of 1,500 deg. C. It will be quite evident that one of the reasons for the slow progress in this direction has been due to the difficulty in attaining these elevated temperatures. There are very few materials at our disposal that will with-

HISTORICAL—Edmund Davy[1] in 1836 discovered a new gas which he reported as being formed by the action of water on potassium carbide. He also reported a number of its important properties which leaves no doubt that the gas he was describing was acetylene. Berthelot named the gas "acetylene" and in a series of researches begun in 1860 made a very careful study of its physical properties. In 1862, Berthelot[2] showed that acetylene could be made by the direct union of carbon and hydrogen in an electric arc. In the same year Woehler[3] made the noteworthy observation that the gas was formed by the action of water on calcium carbide. This observation escaped notice until thirty years later when the reaction became of great commercial importance. Lewes[4] in 1894 converted ethylene to acetylene by direct thermal cracking, operating at temperatures of 900 to 1,500 deg. C. However, his yields of acetylene were very low. Later, Bone and Coward[5] produced small amounts of acetylene from methane, ethane and ethylene.

America pioneered in the development of a commercial method for producing acetylene. While Boehm[6] claimed in a patent application, filed in the United States November 5, 1891, the production of calcium carbide by heating carbon and an alkaline earth by means of an electric current, Wilson in this country is given the credit for making the first calcium carbide in the electric furnace. While attempting to produce aluminum in the electric furnace, he accidently discovered a new and practical method of making calcium carbide. On May 2, 1892 he recognized its importance for the commercial production of acetylene. Three days later he filed a patent application[7]. Henri Moissan reported similar discoveries on December 12, 1892 before the Academie des Sciences in Paris. In 1894 Lewes[8] in London first employed acetylene in a burner for lighting purposes. A greater development was yet to come. Twelve years later in 1906 acetylene was first applied in burners for the welding and cutting of metals.

The production of calcium carbide grew rapidly after the discovery of acetylene welding, reaching a volume of approximately 250,000 tons in 1928. Since then, the increase in plant capacity has not been very rapid, but we now appear to be on the threshold of a greatly increased usage of acetylene and its production by high temperature

consideration is that plant location is not confined to localities of cheap and adequate power supply, a necessary requirement for both calcium carbide production or the use of an electric method of cracking. A location chosen because of suitable power conditions might not be where hydrocarbon materials are cheap and abundant. For thermal cracking a wide choice of plant locations is possible where ample supplies of petroleum or natural gas hydrocarbons are available at a low cost.

Workers in the field of high temperature thermal cracking of hydrocarbons to acetylene have been aware of the possible advantages which have just been pointed out; they have furnished the incentive for the development discussed in this article.

Little progress was made on straight thermal cracking until 1926 when Wulff in this country carried out an extensive study of high temperature, thermal cracking with the view to developing a commercial method for the production of acetylene. He was the first one who recognized the great importance of a combination of short contact time and rapid quenching of the cracked mixture, in obtaining high yields. A series of patents[15] have been issued to him covering the thermal cracking of hydrocarbons to acetylene employing temperatures above 1,500 deg. F., a contact period of less than five seconds, and rapid cooling of the product.

Fischer and co-workers[19] in a series of investigations begun in 1928, showed that by controlling the contact time, good yields of acetylene with very little carbon formation could be obtained at atmospheric pressure.

Simultaneously, other laboratories investigated the pyrolytic method. Tropsch and Egloff[20] studied the pyrolysis of methane, ethane, propane and butane under reduced pressure. Subsequent work was reported by Tropsch, Parrish and Egloff[21] on the pyrolysis of the gaseous olefins. Pyzel[22] showed the thermal cracking of natural gas to acetylene and ethylene, injecting additional natural gas into the hot gases issuing from the converter to produce further quantities of ethylene.

In 1934 a program for commercializing the process of thermal cracking to acetylene was initiated by the Tennessee Eastman Corporation, and it is the purpose of this article to report the development.

LABORATORY TUBE CRACKING

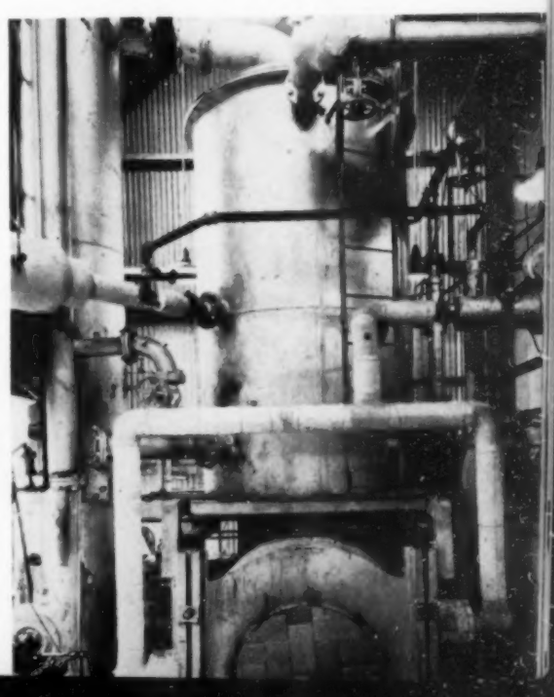
In the earlier work, the optimum conditions for cracking the various saturated, aliphatic hydrocarbons were determined in a laboratory furnace producing 4 to 10 cu.ft. of cracked gas per hr., depending on the type of hydrocarbon processed. In the furnace, a carborundum tube ½-in. i.d. x 2-in. o.d. and 6 ft. in length served as preheater section. It extended through the high temperature zone where the tube was enclosed in an alundum sleeve wound with molybdenum wire. Around the winding was a tight steel box packed with silica-free alundum sand. A slight pressure of hydrogen was maintained in the enclosing chamber as a reducing atmosphere to prevent oxidation of the molybdenum wire. Centered in the carborundum tube, was an alundum tube $\frac{3}{32}$ in. i.d. for the dual purpose of enclosing a platinum-rhodium thermocouple and acting as a core-buster so as to allow a very high gas velocity and consequently a very short contact time.

Gas temperatures of 1,500 deg. C., readily obtained with the furnace, were sufficient to crack methane, natural gas, mixtures of heavy hydrocarbons separated from natural gas, as well as propane, butane and natural gasoline. In all of the work, steam diluent was used and contact times were less than 1/10 sec.

In Table I are shown the results obtained in cracking 28-70 grade natural gasoline at various temperatures. It will be noted that the entire temperature range of acetylene cracking is covered, up to a point where over-cracking occurs. An idea of the mechanism of the pyrolysis process may be gathered by referring to Fig. 1, in which the results are plotted graphically showing the yield of the various carbon containing constituents obtained in the pyrolysis. Portions between the curves show the amount of the products formed at the various temperatures.

It will be noted that even in pyrolysis of natural gasoline, which is a mixture of paraffin hydrocarbons containing five or more carbon atoms, ethane is the highest member of the paraffin series present at slightly above 1,000 deg. C. It disappears above 1,150 deg. C. and the olefins are progressively converted into acetylene—butylene disappearing at about 1,175 deg. C. and propylene at a temperature of 1,350 deg. C. which is optimum for acetylene. An interesting fact is that methane increases until the ethane disappears and then remains substantially constant until 1,400 deg. C. is approached. Benzene is a very stable compound at high temperatures due to its endothermic

One type of horizontal furnace in semi-works scale. Air and gas-steam preheater are in the vertical shell



stand the high temperatures, have sufficient heat conductivity and at the same time be non-catalytic.

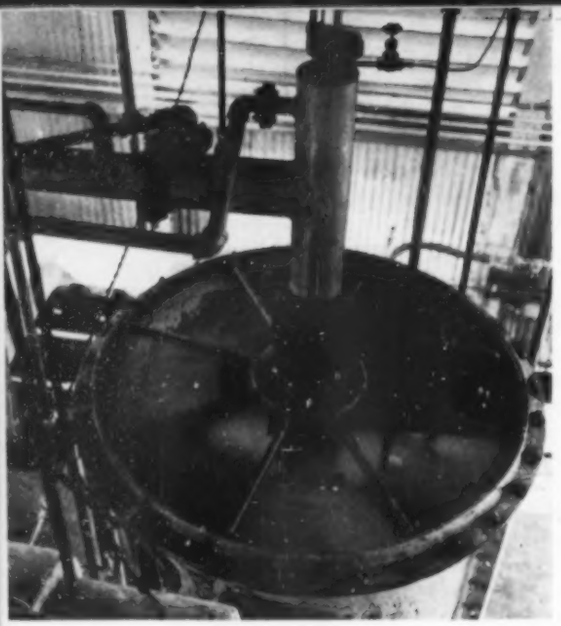
Investigators, in searching for a means of heating saturated hydrocarbons to temperatures required for acetylene production, first chose the electric arc and silent electrical discharge methods. It was possible by passing a rapid stream of hydrocarbon gas or liquid through the arc or silent discharge, to heat it to a very high temperature and by quickly quenching the mixture to obtain appreciable quantities of acetylene. However, in order to obtain good yields it was necessary to operate under reduced pressure or in the presence of an inert diluent. In employing the silent electric discharge the hydrocarbon gas was passed through the apparatus at a low pressure of the order of .01 to 0.1 atm. Thus, on account of the mechanical difficulties involved and the high power requirements the electrical methods did not appear to offer advantage over producing acetylene through calcium carbide.

In the accompanying table are summarized the energy requirements per lb. C_2H_2 as determined by investigators using electrical cracking methods.

It will be noted that the average requirement is about 4.5 kwh. per lb. of acetylene. In calcium carbide manufacture there is a power expenditure of about 3,000 kwh. per ton or 1.5 kwh. per lb. Now when we consider that it requires about 3 lb. of calcium carbide to make 1 lb. of acetylene, the electrical energy is substantially the same for the two methods. Consequently, the economics of C_2H_2 production by pyrolyzing hydrocarbons with electrical energy do not make it appear attractive.

Investigators	Hydrocarbon Cracked	Kwh. per Lb. Acetylene
L'Air Liquid Society[9]	Gas Oil	4.9*
Peters and Pranschke[10]	Methane	4.7
Peters and Wagner[11]	Methane	5.1
Gmelin and Eisenhut[12]	Methane	5.35
Eisenhut, Stadler and Baumann[13]	Methane	4.3
	Methane	4.3
Baumann, Stadler and Schilling[14]	Methane and Homologues	4.35–4.9
Eisenhut, Schilling and Baumann[15]	Methane	5.4*
Baumann, Stadler and Schilling[16]	Propane	4.2
Miloslavskii and Glismenenko[17]	Solar Oil	4.2

*For Acetylene and Carbon Black.



Top of the vertical furnace showing water-cooled, mercury-sealed packing gland

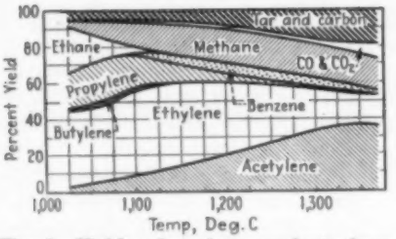


Fig. 1—Yields of various products from pyrolysis of natural gasoline

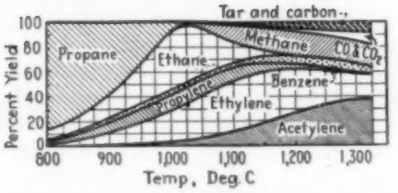


Fig. 2—Products obtained by pyrolysis of propane in laboratory furnace

character and the amount formed continues to increase up to about 1,250 deg. C.

Table II shows a similar pyrolysis study on propane in which the cracking range was extended to lower temperatures. Substantially the same contact times were used as in the case of natural gasoline which makes possible a direct comparison of the two as potential, commercial raw materials. Inspection of the results, shown plotted in Figs. 1 and 2, reveals great similarity. The main differences noted are that propane cracks to optimum yields of acetylene and ethylene at somewhat lower temperatures and the over-all yields of desirable products are considerably improved. In fact, better yields are expected at lower temperatures since the amount of hydrocarbon feed converted to carbon monoxide and carbon dioxide is less, as is also the amount of carbon and tar formed.

Noteworthy, as with natural gasoline, is the fact that practically no methane was formed below 1,000 deg. C., although at this temperature 91 percent of the propane had disappeared. However, approximately 73 percent of the propane had been converted to hydrocarbons containing two carbon atoms—ethane, ethylene and acetylene—with only about 13 percent and 3 percent of propylene and benzene, respectively, being formed. This behavior of propane during pyrolysis in the lower temperature range gives us an insight into the probable mechanism of the cracking. The predominant reaction appears to be the production of methyl, methylene and possibly methine radicals which then combine to form ethane, ethylene and acetylene. At higher temperatures, above 1,000 deg. C., methane forms as a side reaction at the expense of ethane, approximately 25 percent of the ethane disappearing by this route. From the point where the ethane disappears there are no further quantities of methane or the olefines formed. This would tend to show that at high temperatures no methane is formed at the expense of the unsaturated hydrocarbons. At still higher temperatures, as indicated in Table I, the methane begins to crack.

SEMI-WORKS TUBE FURNACES

After determining the optimum conditions for acetylene cracking in the laboratory furnace as regards steam dilution, temperature and contact time, employing various starting materials, the next task was to duplicate the results on larger scale and in unit sizes that could be expanded directly to commercial scale.

The first step was to build a gas-fired furnace with larger carborundum tube. As in the laboratory furnace, it was necessary to use core-busters to obtain the high gas velocities at short contact time for high rates of heat transfer. The first furnace was horizontal containing a single tube. It was increased in size as larger tubes became available from the manufacturer.

In order to obtain the high temperature level within the tubes it was necessary to maintain a very high flame temperature in the com-

Table I — Pyrolysis of Natural Gasoline

Sample No.	1	2	3	4	5	6	7	8	9
Temperature, °C.	1016	1068	1106	1128	1186	1252	1306	1344	1370
Volume increase	3.30	3.67	3.90	4.23	4.54	5.20	5.85	6.20	6.48
Carbon balance—Percent	92.4	93.1	92.9	92.4	90.7	88.4	85.0	85.6	81.2
Gas analyses—Percent									
Carbon dioxide	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.8	1.1
Acetylene	1.5	5.5	6.9	9.3	11.6	15.4	16.9	17.5	16.5
Ethylene	38.5	33.8	34.4	31.8	27.7	18.3	11.5	9.6	7.7
Propylene	10.6	11.5	7.7	6.0	3.2	0.9	0.3	0.2	0.1
Butylene	0.4	1.1	0.5	0.1	0.1	0.0	0.0	0.0	0.0
Benzene	—	—	0.5	0.9	0.9	1.1	0.8	0.6	0.4
Oxygen	0.2	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.0
Hydrogen	20.1	23.1	24.9	26.7	31.0	38.5	45.6	46.7	51.0
Carbon monoxide	0.6	0.7	1.2	1.5	1.7	3.3	4.7	6.2	6.5
Methane	1.5	13.9	18.7	23.5	23.6	21.4	19.1	17.6	16.1
Ethane	26.5	10.9	4.7	0.1	0.0	0.0	0.0	0.0	0.0
Nitrogen	0.2	0.2	0.5	0.0	0.2	0.4	0.4	0.6	0.6

Table II — Pyrolysis of Propane

Run number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Temperature, °C.	800	850	900	950	1000	1025	1050	1075	1100	1125	1150	1190	1225	1250	1275	1300	1325
Steam dilution	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Expansion	1.09	1.16	1.29	1.51	1.64	1.86	1.90	2.14	2.28	2.42	2.56	2.77	3.00	3.11	3.26	3.50	3.66
Percent carbon balance	100	100	100	100	99.6	99.3	98.6	98.0	97.6	96.4	96.6	96.1	94.2	92.8	92.5	93.2	91.5
Percent yield—C_2H_2 + C_2H_4	1.96	4.52	10.65	20.3	25.5	36.1	37.9	47.5	51.8	56.2	58.7	61.3	61.0	60.2	58.8	57.8	57.6
Analysis of cracked gas —vol. percent.																	
CO_2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.4	0.4	0.6	0.6	0.7
C_2H_2	0.2	0.2	0.4	1.1	2.4	3.7	4.0	6.2	7.5	8.9	10.5	13.0	14.8	15.8	15.9	16.4	15.3
C_2H_4	2.5	5.7	12.0	19.4	20.9	25.4	25.8	27.1	26.5	26.0	24.0	20.3	15.7	13.3	11.2	8.9	8.3
C_3H_6	1.9	4.2	7.0	8.4	7.7	6.8	6.7	5.3	4.6	3.5	2.7	1.4	0.9	0.6	0.4	0.2	0.0
C_4H_8	0.8	0.9	0.8	0.9	1.0	0.9	0.7	0.9	0.8	0.8	1.0	1.2	1.1	1.0	1.1	0.9	0.7
O_2	—	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1
H_2	4.0	6.7	11.3	16.1	18.9	23.0	23.4	27.3	30.0	32.6	35.0	39.0	43.5	45.7	47.8	49.8	51.7
CO	—	0.1	0.1	0.1	0.1	0.3	0.4	0.5	0.8	0.9	1.2	2.0	2.7	3.2	3.9	5.7	7.2
CH_4	—	—	—	—	—	3.3	6.3	15.5	17.6	20.1	21.4	21.1	20.4	19.9	18.6	17.0	15.7
C_3H_8	10.7	15.5	22.0	33.7	40.0	36.2	32.3	16.7	11.6	6.6	3.5	1.4	0.2	0.0	0.0	0.0	0.0
C_4H_{10}	79.8	66.5	46.1	20.1	8.8	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N_2	—	—	—	—	—	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.4	0.4	0.3

Table III—Pyrolysis of Natural Gasoline with Recirculation of Ethylene

Run number	1	2	3	4	5	6	7	Calc.
Temperature, °C	1310	1266	1308	1290	1290	1306	1307	1300
Mol fraction—gasoline	0.214	0.162	0.208	0.211	0.199	0.224	0.217	0.215
—recycle	0.786	0.838	0.792	0.789	0.801	0.776	0.783	0.785
Steam dilution	4.8	4.5	4.5	5.0	4.4	4.0	4.4	4.8
Expansion—measured	2.55	2.12	2.44	2.34	2.37	2.21	2.58	—
—calculated	2.54	2.09	2.42	2.37	2.32	2.46	2.54	2.40
Percent carbon balance	92.5	91.6	89.9	90.4	90.4	87.1	89.1	91.3
Percent yield C_2H_2	51.9	53.5	53.2	49.4	48.9	46.4	51.5	48.4
Analysis of cracked gas —vol. percent								
CO_2	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.5
C_2H_2	15.3	14.5	16.0	15.4	14.7	14.8	15.4	15.4
C_2H_4	15.2	18.3	14.8	17.0	17.3	16.1	14.6	18.3
C_3H_8	1.0	1.0	0.8	0.8	0.8	0.8	0.5	0.9
C_4H_8	0.6	0.8	0.9	0.8	0.8	0.6	0.6	1.1
O_2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
H_2	40.1	37.7	41.0	39.0	38.8	40.9	41.8	38.5
CO	5.3	3.0	3.8	3.3	3.5	3.4	4.5	3.3
CH_4	21.1	23.1	21.8	22.8	22.9	22.4	19.9	21.4
N_2	0.6	0.4	0.3	0.3	0.6	0.4	1.2	0.4

bustion chamber. This was accomplished by employing an air preheat of 500-600 deg. C. Preheat was obtained from the combustion gases leaving the cracking chamber and passing through an auxiliary preheater section. The incoming hydrocarbon feed and steam mixture was likewise heated[23] to 800 deg. C. in alloy steel coils in the same preheater assembly.

Although laboratory cracking results were duplicated with the various hydrocarbons processed, refractory and mechanical difficulties arose. Trouble was soon encountered with the horizontal type of furnace due to sagging of the carborundum, although the unsupported tube span was only over a 4-ft. length. At first this was thought to be due to rigidity of connections at the two ends of the tube but the sagging still persisted after flexible water-cooled connections were provided at the tube ends. The strains were apparently induced by compression and tension at the top and bottom respectively, because the tubes failed from circumferential cracks after only a few days. It is to be pointed out that we were attempting to operate in an unexplored field for carborundum tubes, as far as temperature and rate of heat transfer through the wall was concerned. Also the tubes were larger in diameter and length than had been fabricated heretofore. The illustration (p. 79) shows one type of horizontal furnace. The gas-steam and air preheater is shown above the furnace enclosed in the vertical shell.

In the attempt to obtain improved tube life it was decided to build a vertical furnace. It was designed for a carborundum tube 4 in. i.d. x $5\frac{3}{4}$ in. o.d. and 8 ft. in length, provided with a $3\frac{1}{4}$ in. diameter core-buster of the type to be described. The bottom of the tube was rounded to fit into a machined water-cooled seat made tight with an asbestos-lined copper gasket. The top of the tube extended through a loose hole in the refractory lining. The top of the tube was gas tight, yet perfectly free to move in all directions by a sylphon type packing gland[24] water cooled and provided with a mercury seal.

In operating the furnace the gas-steam mixture, preheated to 800 deg. C., entered the bottom of the tube where the pressure was balanced with respect to the combustion chamber surrounding the tube by the use of a Hagan regulator. The balance was maintained by operating a by-pass valve on the Nash blower pulling the gas through the tube. At the high-gas velocity a 3 lb. per sq.in. pressure drop occurred from the bottom to the top of the tube and yet the top seal was gas-tight.

The underside of the domed top had a suspended lining of high-alumina, refractory shapes. The accompanying illustration shows the dome, the top of which was water-cooled. The water-cooled, mercury-sealed packing gland is also visible. Connecting with the gland was a 2-in. water cooled pipe 15 ft. in length which cooled the cracked gas to 400 deg. C. before it entered a gas seal box type of quencher. The velocity of the gas was so great and consequently the heat transfer was so high that no tar deposited in the wall of the tube. In other words, the inside wall temperature was never lower than the dew-point of the tar. Based on this experience a fire-tube boiler, designed for the same rate of heat transfer, would be practical on a larger unit to generate steam for power required in concentrating the gas and the necessary low pressure steam for gas dilution.

Types of core-busters. One shown at the left proved most satisfactory

A considerable study was made of core-busters. The most satisfactory was one with smooth sides and with centering lugs. A center hole was provided for insertion of the thermocouple.

The furnace was fired by two tangentially placed burners[25] located near the top of the furnace. They were provided with sylphon diaphragms to take up unequal expansion due to the use of preheated air.

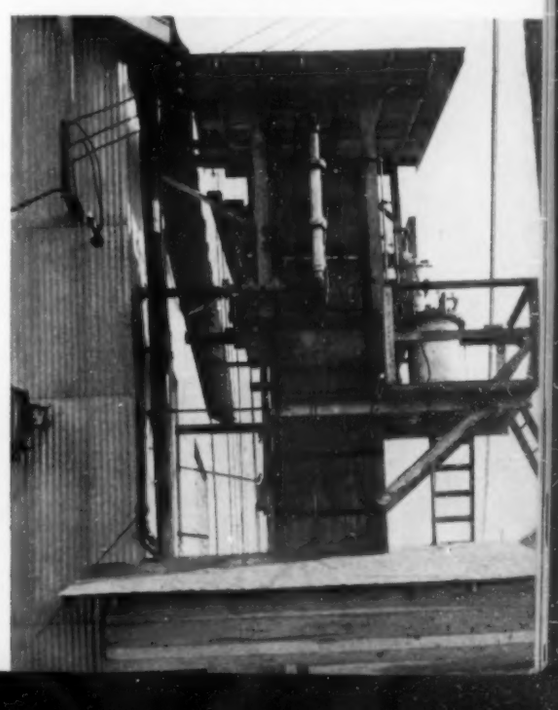
Operation of the vertical tube furnace was much more successful than with the horizontal type. After a period of over a year's operation on a 24-hr. basis, a three month tube life was established. Yields of acetylene were equal to those obtained in the laboratory. Carbon was blown on the average every 36 hr., while on the laboratory furnace it had to be blown every hour.

RECIRCULATORY CRACKING

Inspection of Table I, containing results on natural gasoline cracking, indicates that Sample 6 represents about the optimum cracking condition. Acetylene and ethylene are present to the extent of 15.4 and 18.3 percent respectively. For greatest economy of raw material both the acetylene and the ethylene should be utilized. A simple cost computation will show that the process would not be very attractive if operated only for acetylene unless cracking were carried out at a considerably higher temperature.

It seemed most likely that in the majority of cases it would be most

Semi-works regenerative furnace with seal box type of quencher



desirable to be able to operate the process economically for acetylene alone. It was thought that this might be accomplished by some type of recirculatory cracking. In order to test the idea the gas was separated[26] into three fractions—concentrated acetylene, concentrated ethylene and fuel gas. By compressing the cracked gas to 300 lb. gage pressure and using a proper choice of solvents we were able in one stage absorption to produce a 70-80 percent acetylene gas, a 50-60 percent ethylene, and leave a fuel gas having a calorific value of about 450 B.t.u. per cu.ft.

Cracking with recirculation of the ethylene fraction[27] was most successful. In addition to ethylene, some methane representing about 60 percent of that formed in single pass cracking was also recirculated. The success attained in recirculation of ethylene indicated that at a definite contact time and cracking temperature, for a given hydrocarbon feed, there was an equilibrium established, and by returning the equilibrium amount of ethylene the net effect was that the fresh hydrocarbon feed is pyrolyzed directly to acetylene. The enhancement in acetylene yield, based on new charge stock fed, due to recirculation of concentrated ethylene is illustrated quite simply in butane cracking. In the table below is a comparison of results in single pass and recirculatory cracking.

	Single Pass		Recirculation	
	Vols. Feed Gas	Vols. Cracked Gas	Vols. Feed Gas	Vols. Cracked Gas
Butane	100	—	26.0	—
Acetylene	—	55.0	—	27.4
Ethylene	—	56.7	29.5	29.5
Methane	—	86.0	44.5	62.0
Hydrogen	—	162.0	—	76.5
Benzene	—	1.2	—	1.0
Carbon Monoxide	—	12.0	—	8.7
Carbon Dioxide	—	3.0	—	1.5
Acetylene Yield (Based on Butane Fed)		27.5%		52.3%

It is to be noted that the yield of acetylene based on butane fed has been practically doubled and at the optimum operating point, represented by the above condition, there is no net gain in ethylene during the cracking. In effect, the recycled ethylene is converted into acetylene thus making it a low cost acetylene process without a byproduct ethylene credit. An additional advantage is that about 10 percent less heat is required with recirculation than in single pass cracking.

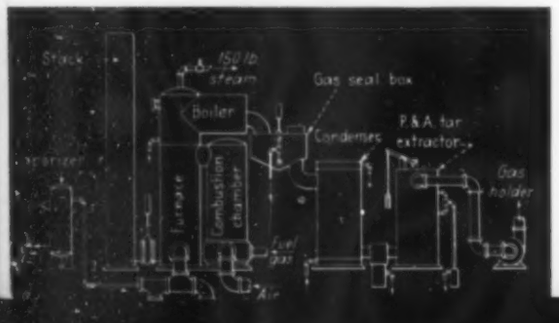
Recirculation of ethylene has accomplished the attainment of maximum acetylene yields at temperatures which are conservative as far as refractory life is concerned. Such yields can only be approached but never equalled at much higher temperatures in single pass cracking.

Table I contains results on a single pass cracking of 28-70 grade natural gasoline. Table III is on the same material using recirculatory cracking. The calculated run in the latter table is based on Run 6 from Table I. Noteworthy is the fact that there is no fundamental difference in the type of gas analysis obtained in single pass and recirculating cracking since the calculated run is almost identical with the experimental. The acetylene yield, however, was increased from 26 to 48.4 percent. Thus the dual purpose served by this development was the concentration of acetylene to a point where it was more suitable for chemical conversion and the yield of acetylene was almost doubled.

The development of recirculatory cracking firmly established the economy of the process as far as raw material costs were concerned. However, an engineering study of the investment cost for a plant using tube furnaces for cracking did not present any too favorable picture. It did not seem practical, for many reasons, to build furnaces with more than a limited number of tubes per unit, which would lead to high labor costs. Other factors operating in the same direction would be frequent blowing of carbon and also tube replacements.

Another serious disadvantage was that indirect transfer of heat through tubes for heating hydrocarbons to the neighborhood of 1,300 deg. C. required extremely high flame temperatures which could only be attained by using preheated air for combustion. The high flame temperatures had not only a very punishing effect on the carborundum tubes but also on the refractory of the furnace linings. For the latter only an expensive, high alumina brick could withstand the temperature without considerable shrinkage and spalling.

Fig. 3—Complete cracking unit assemblage for a commercial plant



REGENERATIVE FURNACE

The alternate method for bringing a gas to a high temperature is by its direct contact with a surface which has been previously heated—in other words, in a regenerative type of furnace. This method of cracking had not been overlooked in the early work but no satisfactory solution was found. In some early types of furnaces broken carborundum packing was alternately fired with combustion gas and in turn gave up its heat to the hydrocarbon cracked. However, the acetylene yields did not compare with those obtained in tube-cracking. Also trouble was encountered with a building up of carbon which was not removed during the heating cycle. In time the carbon became graphitic in nature and could not be burned out even with oxygen.

As a result of the extensive work on tube cracking, a large amount of experience was gained on optimum temperatures, contact times, rates of heat transfer with carborundum and heat absorption by the refractory by convection and radiation, so that a satisfactory solution could be worked out for the design of a regenerative furnace. Accordingly, a semi-works furnace was constructed with carborundum brick work laid so as to present vertical, uninterrupted slots very narrow in width. The slots were bounded by carborundum of sufficient thickness to furnish the necessary heat storing capacity and yet thin enough to prevent spalling from heat shock.

At a selected optimum cracking temperature and contact time, the variables concerned in the solution of the problem were the surface and heat capacity of the carborundum, in the cracking zone, and the volume of the gas passage. For a given rate of charging stock — hydrocarbon-steam mixture—the relationship between the dimensions or parameters was found to be very critical if optimum cracking results were to be obtained.

Once the relationship was established, the length of the cracking period was fixed. The complete cycle was quite definitely set at 1½ min. cracking and 3 min. heating times. Although it is desirable to have the cracking and heating periods as long as possible, the upper limit is governed by the maximum thickness of the refractory, bounding the gas passages, which will conduct the heat to and from the surface at the high rates employed without spalling.

It might be noted that carborundum is the only commercially available refractory which meets the drastic requirements of high heat conductivity, coupled with a satisfactory coefficient of thermal expansion and physical strength. Under actual cracking conditions an average heat liberation from the surface of the

carborundum averaged 50 B.t.u. per sq.ft., in thickness, deg. F., hr., for the entire length of the gas passage. We were, therefore, withdrawing heat to the cracking mixture at a rate approaching the conductivity of carborundum itself which is about 100 B.t.u. per sq.ft., in. thickness, deg. F., hr. Radiation was playing an important role, particularly in the hot zone, in attaining the high heat transfer coefficient to the gaseous mixture traversing the channels.

From the above considerations, it is quite apparent that no other refractory than carborundum could serve. Among commercial refractories, magnesite and zirconia approach the nearest to carborundum with about one-fourth the heat conductivity, but they would be impractical to use since the tiles would have to be extremely thin and the cracking cycle of very short duration. If the thickness were the same as in the case of carborundum, conduction within the body of the refractory would be slower than the gases in the two parts of the cycle were adding and withdrawing heat at the surface and as a consequence severe spalling would result.

The development of the regenerative furnace thus involved satisfying of a great many requirements as regards properties of the refractory, temperature, contact time, heat capacity, and transfer and pressure drop within the cracking zone. A satisfactory solution was found and the cracking results obtained with the hydrocarbons equalled in every respect those in laboratory and semi-works tube cracking. An example is given in the following table on the cracking of butane.

	After 15 Sec.	After 90 Sec.	Average Entire Cycle
Carbon Dioxide	1.6	0.8	1.1
Acetylene	14.1	11.2	12.3
Ethylene	16.5	23.0	17.6
Benzene	0.5	0.6	0.6
Oxygen	0.2	0.2	0.3
Hydrogen	39.4	33.2	38.0
Carbon Monoxide	3.3	1.2	1.7
Methane	22.2	27.4	26.4
Ethane	—	1.0	0.6
Nitrogen	1.5	1.4	1.4

The accompanying illustration, (p. 81), shows the semi-works regenerative furnace and closely connected with it the gas seal box type of quencher. Fig. 3 is a drawing showing the complete cracking unit assemblage as required for a commercial plant. It will be noted that a boiler is provided for generating sufficient steam to furnish the power for compressing the cracked gases for the absorption unit. With steam-driven compressors operating on a 5-lb. exhaust, the requisite amount of steam is available for diluent in the cracking operation. For a continuous supply of cracked gas and steady operation of auxiliary blowers and exhausters three furnaces are required. Automatic time cycle controllers to actuate the valves for process gas, steam, fuel and combustion air are of the same type as in water gas practice. When combined with the automatic flow controls of the various feeds, the operation of the units becomes almost entirely automatic.

The regenerative furnaces for acetylene cracking are surprisingly small in size, since they operate at a tremendously high rate of heat absorption and withdrawal. They possess an added advantage in that there is no build up of carbon, it being completely burned out during each heating portion of the cycle. The carborundum in the high temperature zone is subjected to a much lower temperature than in the case of tube cracking which leads to greater refractory life.

ADAPTABILITY

As has been indicated, the thermal process can be operated in a single pass manner so as to produce both acetylene and ethylene or by recirculation of the latter to produce only acetylene. In both cases a gas separation system is desirable since it is not as economical to convert a dilute gas chemically.

One of the more important advantages over olefin cracking, if ethylene is desired, is that it can be operated so that there are no propylene or higher olefins produced. This avoids the necessity for an expensive low temperature liquefaction system to separate the higher olefins from ethylene. An additional feature is that the acetylene is completely removed from the ethylene which is desirable when certain types of chemical conversions are to be carried out.

Fig. 4 is a flow diagram showing operation with recirculation of ethylene to yield a concentrated acetylene as the sole product of the cracking to be removed. As pointed out previously, this operation substantially doubles the yield of acetylene since in effect the recycled ethylene is converted almost quantitatively into acetylene. The heat and steam balance of the system is also indicated—the hydrogen, methane and carbon monoxide furnish the heat for the furnace; the generation of high pressure steam from the sensible heat of the cracked gas supplies the power for compression of the same gas and the low pressure steam serves for diluent in the cracking process. Thus

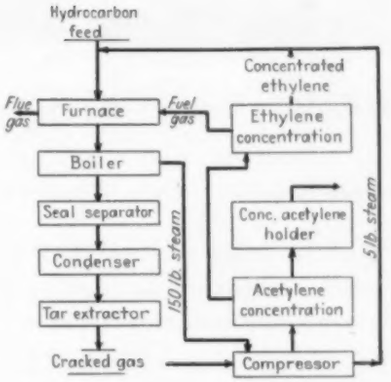


Fig. 4—Flow diagram of cracking operation with recirculation of ethylene

the energy requirements for the production of acetylene by high temperature cracking are supplied by the byproducts of the process and are included in the cost of the hydrocarbon charging stock.

Another no less important advantage of producing this most important building block for organic syntheses by thermal cracking is that no special metals are required for the construction of the plant. Ordinary steel and cast iron are satisfactory, since no corrosive conditions are encountered in any part of the operation.

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(23) Hasche, U. S. 2,236,535 (Apr. 1, 1941).
(24) Hasche, U. S. 2,196,766-7 (Apr. 9, 1940).
(25) Trinks, U. S. 2,183,596 (Dec. 9, 1939).
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(27) Hasche, U. S. 2,236,534 (Apr. 1, 1941).

Priorities Undergo Important Changes

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Chem. & Met. INTERPRETATION

Three sweeping changes in the priorities system affecting strategic materials were made effective July 1: (1) First and most important, nearly every company using more than $5,000 worth of basic metals in a calendar quarter must now file an application under the Production Requirements Plan showing actual consumption, inventories and future requirements. PRP supersedes all other priority instruments in the field it covers. (2) All orders placed after July 1 and all previously placed orders calling for delivery after July 31 must now carry the explanatory symbols of the new Allocation Classification Systems. This is the so-called "End-Use" method of designating industrial essentiality in the war effort and is described in detail in the accompanying article. (3) The form of applying and extending all preference ratings has now been made uniform to simplify future procedures. To assist our readers in understanding and applying the new End-Use classifications, the author of "Preference Ratings are Up to You" (Chem. & Met. Oct. 1941, pp 86-91) has prepared this interpretation.—*Editors.*

NO MATTER what you order or where you order it, your order is no longer acceptable by your supplier unless it carries a definite designation of end use. Moreover, *all* orders now in the hands of your suppliers for delivery after July 31st must be classified by you as to end use, before they can be shipped. Therefore, it will be necessary for all chemical and related producers to understand the implications of WPB Priorities Regulation No. 10 which makes this end-use plan mandatory.

It is really not as complicated as it might seem. To get at the crux of the situation, most producers of chemicals will utilize the symbol: 8.20 to indicate that the end use of the materials, equipment, supplies and other things they are ordering is in the chemical field. This symbol goes on all orders placed by the chemical company, even though certain items to be ordered may have been identified with other end uses either by end-use symbols on orders from customers of the chemical company, or by preference ratings indicating such other end uses.

In other words, you will pay no attention to end-use symbols provided on orders to you by your customers, but hold to this symbol 8.20 (or the symbol designated by Priorities Regulation No. 10 for your industrial group) on all orders you place. Symbol 8.20 includes the production or processing of all chemicals such as chlorine, alcohol, and sulphur and includes paint, lacquer, plastics, synthetic rubber, etc. A detailed alphabetical list of chemical and related products, and the end use symbols assigned under Priorities Regulation No. 10 is shown in Table I. There is also included in Table II a list of various industrial and chemical equipment and machinery, with the end use symbol assigned to each.

You may find that your particular products will call for some other end-use symbol than 8.20 and, of course, you may be faced with the problem of a diversified group of products which might call for a number of different end-use symbols. If, however, the major portion of your production falls into a single symbol class such as 8.10, 8.20 and 8.90, you can use the symbol 8.00 to cover all such production.

In those comparatively rare cases where end-use symbols cover more than one class, you are required to utilize the symbols for each of your products with different class symbols the volume of which exceeds 5 percent of your total volume.

However, if you are engaged in sub-contracting, involving materials radically different than those in your regular line, it would be advisable to utilize the alphabetical guide in Priorities Regulation No. 10 to classify such items as directed there.

In addition to the end-use symbols discussed above, there is another group of symbols which must also appear on each order. These supply the W.P.B. with information as to whether the orders are placed for the Army, the Navy, Lend-Lease, Domestic Purchases or other Foreign Purchases besides Lend-Lease. A series of five "designation" symbols are set up for this purpose. *USA* represents the Army; *USN*, the Navy, including the Maritime commission; *LL*, Lend-Lease; *FP*, other Foreign Purchases; and *DP*, Domestic Purchases.

As the system is laid out, most of this last group of "designation" symbols will originate with your customer or customer's customers. In other words, if the Army has ordered anything from a supplier who in turn orders something in connection with that order from another supplier who comes to you, it is mandatory that the symbol *USA* shall be passed on in each case. The same applies to each of the other symbols in appropriate cases.

So when any such order comes to you with any one of these "designation" symbols, you will in turn pass it on in connection with any order you make for supplies which are needed for the order you have received with this symbol.

However, you must not pass on the end-use symbol but instead use the one you are directed to use in Priorities Regulation No. 10, as indicated in the lists shown in Tables I, II and III.

This is true in practically all cases, particularly in the chemical and metallurgical fields. There are a few industries where the order specifically instructs the use of the end-use symbol obtained from customers. These are listed in Table III, and are practically all producers of machinery or equipment.

In using these symbols the five "designation" symbols are to appear first on the order, i.e., *USA, USN, LL, DP* or *FP*, followed by the appropriate end-use symbol. Thus, the order you issue where you have obtained a *USA* "designation" symbol

will show "*USA-8.20* to indicate that you are a chemical manufacturer who needs the product ordered to fill an order which will ultimately be used by the U. S. Army.

But where you are ordering material on which a passed-on "designation" symbol is not involved because you are ordering in quantity for anticipated needs, or because you have no way of relating your order to any "designation" symbol, then you will use the *DP* symbol.

Of course, if you are working on a direct Army contract and are the prime contractor, you will be authorized to use the symbol on orders to your suppliers. The same applies to both Lend-Lease and U. S. Navy contracts.

Remember, however, that even in such cases, you will utilize the end-use symbol called for by Priorities Regulation No. 10, even though the material you make goes directly into a product used by the Army or the Navy.

Note also that you use the end-use symbol *applying to your industry for operating, maintenance and repair supplies* and do *not* use the class 22 symbol designated for *manufacturers* of operating, building, repair and maintenance supplies.

You will find, however, that Priorities Regulation No. 10 specifies that where you function as a prime contractor and are ordering materials for a new building or for a building operation resulting from plant expansion, you will not use your regular industry coding, but instead will use the code 21.10. Otherwise, use your industry end-use symbol, even for such building supplies. Ordinarily your contractor will issue such orders and use symbol 21.10.

This applies to all industrial buildings except those that are Government owned and producing war goods in which case the class 7 symbol should be used.

The purpose of this new end-use coding of orders is the obtaining of data which will insure allocation of scarce materials on a basis compatible with war demands. You will find that once the system is well established, the data you obtain will be of great value to you in presenting your case to the W.P.B. on form PD-25-A under the production requirements plan in particular, and in fact, on any other priorities application forms.

The PD-25-A form to be used for applications under the production requirements plan for the fourth quarter of 1942 will be set up to utilize the data obtained by this end-use and "designation" symbol system.

In actual practice, since the responsibility of placing the symbol on the order is in the hands of the buyer, each seller should obtain adequate data for end-use classification by keeping a suitable record of the orders he receives. (You cannot put these symbols on orders from your customers. Only they can do this.)

It is expected that the system will not work perfectly at first but in view of its simplicity and its mandatory nature, it should not take long for everyone who has passed through the priorities mill to use it readily.

As a matter of fact, this system should be welcomed by industry as a whole because it will enable a great many firms who have had difficulty in establishing the full extent of their relation to essential war efforts to show how extensively they are thus identified. Remember that all ratings were not necessarily *always* extended, since any supplier who could deliver a needed article or material without need for extending the preference rating he had received could break the chain which might otherwise have identified the last supplier in a long, long chain with essential war work.

Table I.—Chemical and Kindred Products Listed According to End-Use Classification

	End-Use Symbol
Abrasives	22.00
Acetone	8.20
Acids	8.20
Alum	8.20
Ammunition for private use	18.00
Artificial leather	8.90
Asbestos	8.90
Asphalt	8.90
Baking powder and yeast	14.00
Beet sugar	14.00
Blast-furnace products	8.10
Bluing	8.20
Bone black, carbon black, lamp black	8.20
Brick and hollow structural tile	8.90
Buttons	15.00
Camphor	8.20
Candles	23.00
Cane sugar	14.00
Carbon paper	19.00
Cellophane	8.20
Cement	8.90
Chewing gum	14.00
China firing and decorating	16.00
Chlorine	8.20
Cleaning and polishing preparations	22.00
Coal-tar products	8.20
Coke	9.30
Colors and pigments	8.20
Compressed and liquefied gasses (except petroleum)	8.20
Concrete products	8.90
Cooking and other edible fats and oils	14.00
Copper refineries, operation of	8.10
Corn syrup, sugar, oil and starch	14.00
Cosmetics	12.20
Cottonseed oil	8.20
Dextrine and dextrose	8.20
Drugs and medicines	12.20
Dyeing and finishing textiles	8.90
Dyestuffs, natural and artificial	8.20
Essential oils	8.20
Ether	8.20
Feeds for animals and fowls	13.00
Fertilizers	13.00
Fireworks	18.00
Fish and marine oils	8.20
Flavorings	14.00
Floor and wall tile	8.90
Fungicides	13.00
Furs, dressing and dyeing	8.90
Gas, natural and manufactured	9.40
Gasoline	9.20
Gelatine	8.20
Glue and gelatine	8.20
Grease and tallow (except lubricating)	8.20
Gum naval stores	8.20
Gypsum products	8.90
Insecticides and fungicides	13.00
Insulation and mineral wool	8.90
Knitted cloth	8.90
Lead and lead foils	8.10
Leather, tanning	8.90
Lime	8.90
Liquors, distilled	14.00
Malt	14.00
Malt liquors	14.00
Manufactured gas	9.40
Medicines	12.20
Mining operations	8.10
Natural gas	9.40
Natural graphite	8.90
Nitrates	8.20
Non-alcoholic beverages	14.00
Non-clay refractories	8.90
Oil (petroleum)	9.20
Oil cloth	8.90
Oleomargerine	14.00
Paints, varnishes, lacquers	8.20
Paper and paper-board operations	8.90
Perfumes and cosmetics	12.20
Petroleum	9.20
Phosphorus	8.20
Plastic raw materials	8.20
Printing ink	17.10
Processed waste and recovered wool fibers	8.90
Pulp mill operations	8.90
Rayon yarn, thread and fabrics	8.90
Salt	8.20
Sand	8.90
Shellac	8.20
Smelters, operation of	8.10
Soap	12.20
Sodium compounds	8.20
Soybean oil	8.20
Sulphur	8.20
Tanning materials	8.20
Tin and other foils	8.10
Tobacco and snuff	14.00
Toilet preparations	12.20
Turpentine and rosin	8.20
Varnishes	8.20
Vegetable oils	8.20
Vinegar and cider	14.00
Wallboard and wall plaster	8.90
Wallpaper	16.00
Wines	14.00
Writing ink	19.00

Table II.—Processing Equipment and Industrial Machinery Given Classification 20.20

Bake Ovens for Commercial Use
Baking Machinery
Beet-sugar machinery
Bottling machinery
Brewhouse machinery
Cane sugar machinery
Canning machinery
Cement mixers
Chemical machinery and equipment
Clay working machinery
Combing machinery (textile)
Leather working machinery
Measuring instruments
Mining machinery and equipment
Paint-making machinery
Paper-mill and paper products machinery
Pasteurizers
Scales and balances
Special industrial machinery
Spinning machines
Tobacco machinery
Textile machinery
Vibrators, industrial

Table III.—Industrial Equipment on which the End Use Obtained from Customers Must be Transmitted

Air compressors
Barrels, drums, kegs
Batteries, storage and primary
Bearings
Bolts, nuts, washers
Conduit and fittings
Cooperages, barrels, kegs, tubs
Diesel engines
Electric motors
Electric outlets, plugs, sockets, switches
Fiber cans and tubes
Furnaces, industrial
Gaskets
Gears
Generators
Internal combustion engines
Mechanical furnace stokers
Oil burners, industrial
Power boilers
Sinks
Valves

Protective Measures for Aluminum Equipment

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Chem. & Met. INTERPRETATION

Now that the federal government is allocating almost all aluminum as soon as it is produced to the airplane industry, it behooves the process industries to make every effort to protect their aluminum equipment so as to reduce the necessity for replacement. The authors suggest several measures that have proved beneficial and therefore should be considered if corrosion occurs. —*Editors.*

ALUMINUM and its alloys are widely used in constructing certain types of equipment for the process industries. For most of these applications, little or no reaction occurs between the substances being processed and the aluminum. In other cases, some reaction may occur. In cases of the latter type, it is often possible to extend the life of equipment appreciably by suitable protective measures. At the present time, nearly all available aluminum is needed for military purposes, so that it becomes imperative to utilize any protective measures which will reduce the need for replacement of equipment.

Several protective measures which have proved beneficial are available. These methods of protection include:

1. Cathodic protection
2. Protective coatings
3. Chemical inhibitors
4. Periodic cleaning

Each of these methods has special fields of usefulness. Cathodic protection is particularly suitable for preventing attack by unrecirculated waters and by nearly neutral or slightly acid salt solutions. The liquids must have a relatively high conductivity and only areas of the metal exposed in contact with the liquid can be cathodically protected. In cases where it is applicable, cathodic protection is usually the cheapest and most effective method of preventing attack.

Chemical inhibitors are particularly useful in recirculated waters or in cases where the same material is to be stored for relatively long periods of time in the equipment under consideration. As with cathodic protection, only the metal areas below the liquid level are normally protected by inhibitors.

Protection against more severe conditions, such as the stronger acids, can best be obtained by coatings. These can be applied most readily to new equipment or to units which can be easily handled.

Periodic cleaning has proved most useful in cases where solid products settle out on the metal surface and adhere tenaciously to it. It is generally of little use where the liquids being processed uniformly dissolve the metal surfaces which they contact.

CATHODIC PROTECTION

The electrochemical theory of cathodic protection has been discussed in several recent papers (R. B. Mears and R. H. Brown—*Trans. Electrochem. Soc.* Vol. 74, p. 519, 1938. R. H. Brown and R. B. Mears —*Trans. Electrochem. Soc.* Vol. 80, 1942), and it is assumed that the reader is familiar with the principles of this method.

Protection of aluminum equipment by means of zinc or zinc-bearing aluminum alloy attachments has been successfully employed in a number of installations (R. B. Mears and H. J. Fahrney—*Trans. Amer. Inst. Chem. Eng.* Vol. 37, p. 911, 1941). In most of these cases protection against corrosive waters has been required although this method has been used with equal success to prevent attack by weak acids and brines.

Brief descriptions of several of these installations will illustrate typical conditions under which cathodic protection is effective and the manner in which protective strips are applied.

Jacketed crystallizing tanks of aluminum were being attacked by unrecirculated cooling water. This water was extremely high in chlorides and total solids. The rate of attack at the air-water interface on the outer tank wall was such as to necessitate repair after as little as nine months of service, and replacement of the tank after two or three years of service. Zinc strips were attached to the jacket walls of the crystallizers, including several new units, in April, 1939. Examination in March, 1942, revealed no perceptible corrosion on the units which were new when the zinc strips were installed. It was also found that the corrosion which had started in the older units had been completely arrested. The zinc attachments of several tanks were almost entirely consumed after this three-year period of use and must soon be replaced. If the life of zinc attachments of the size originally installed is assumed to be three years, it can be calculated that the cost of protecting these tanks is approximately $5 per year. The cost of the tanks themselves was about $1,000. Thus, the cost of protection, in this case, was about 0.5 percent per year.

Attack by cooling waters used in condensers is common. In the case of a certain condenser with an insulated shell, aluminum heads, and aluminum tubes, acetic acid is condensed inside the tubes and caused no serious attack, however, the unrecirculated cooling water attacked the outside surface of the tubes. This attack was probably accelerated by galvanic action between the aluminum tubes and the steel shell. After the tubes had been replaced several times at relatively short intervals, zinc strips were attached to the shell

in the manner indicated in the picture. While it has not been possible to examine the tubes since the zinc strips were installed, the fact that the condenser has operated without tube replacements for a period several times longer than the former interval between tube replacements indicates that cathodic protection has been effective.

Experience in these installations, and in others, seems to justify the conclusion that this method of protection will adequately prevent attack of aluminum alloys by most waters.

While the use of cathodic protection to prevent attack by brines or weak acids has been limited, it has proved effective in several cases. In one case there are two insulated aluminum tanks in which a hot emulsion of wood gum and brine is permitted to separate. The brine contains acetic and formic acids, as well as heavy metal compounds. Attack of the tank bottom was quite rapid and replacement of the bottom was formerly necessary after about one year. Zinc strips were installed in the bottoms of the tanks in May, 1940. When examined in January, 1942, it was found that no further attack had occurred since strips were installed.

In laboratory tests, the ability of zinc to effectively prevent attack of aluminum by a sludge consisting of brine and iron sulphide in solutions saturated either with air or hydrogen sulphide has been demonstrated. This suggests the possibility of protecting crude oil storage tanks and petroleum refinery equipment by this method.

While experience indicates that cathodic protection is effective in a wide variety of waters and in some brines and weak acids, it does have certain limitations. It is essential, of course, that zinc be anodic to the aluminum alloy in the particular solution involved. Zinc is usually anodic to aluminum in neutral or acid solutions and sometimes in weakly alkaline solutions. In strongly alkaline solutions however, aluminum becomes anodic to zinc, and this method of protection cannot be used. There is also some evidence that aluminum may become anodic to zinc at elevated temperatures. For these reasons, a laboratory determination of the potential between zinc and aluminum in the solutions and at the temperatures involved should be made before zinc attachments are installed.

It has not yet been possible to reduce the selection of sizes and the distribution of the zinc strips to an exact science. The protective influence of the zinc usually extends for at least 18 in. from it and, in some cases, protection is afforded at distances several times as great. It is necessary, however, to rely upon experience and judgment in determining the distribution of the zinc strips.

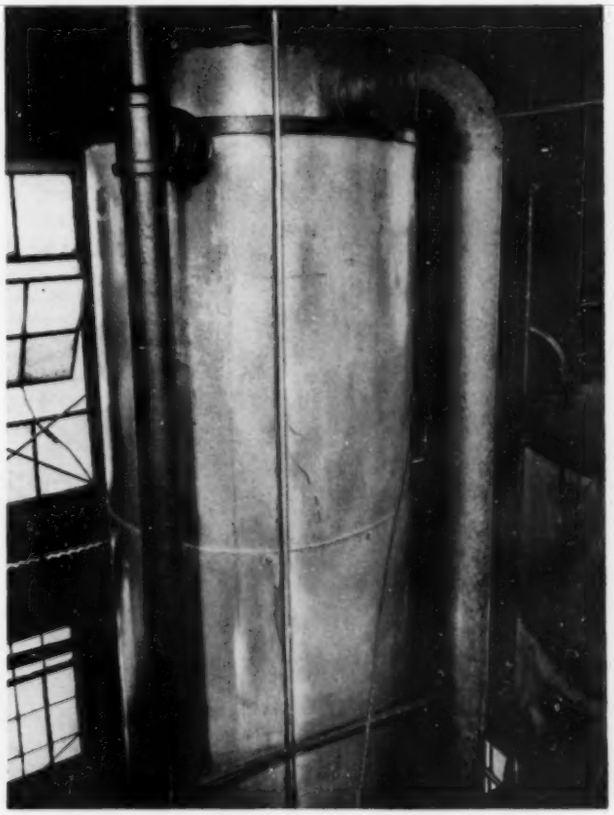
CHEMICAL INHIBITORS

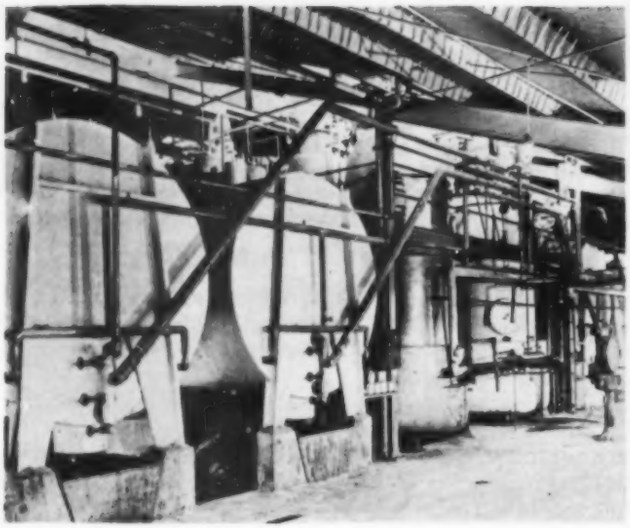
It is sometimes desirable to use aluminum or its alloys in contact with corrosive waters. Thus, for example, a jacketed processing vessel is required. Aluminum or one of its alloys may be ideally suited for contact with the product being treated. However, the water used for cooling or heating purposes in the jacket may cause some attack on the aluminum. If this liquid is recirculated it is often feasible to treat it with a chemical inhibitor in order to render it non-corrosive. Many chemicals possess inhibitive properties. Up to the present, however, only three types of substances have been widely used for this purpose. These are the chromates, the silicates, and the soluble oils. A few examples will be given to illustrate the use of these inhibitors.

A battery of large, jacketed alumi-

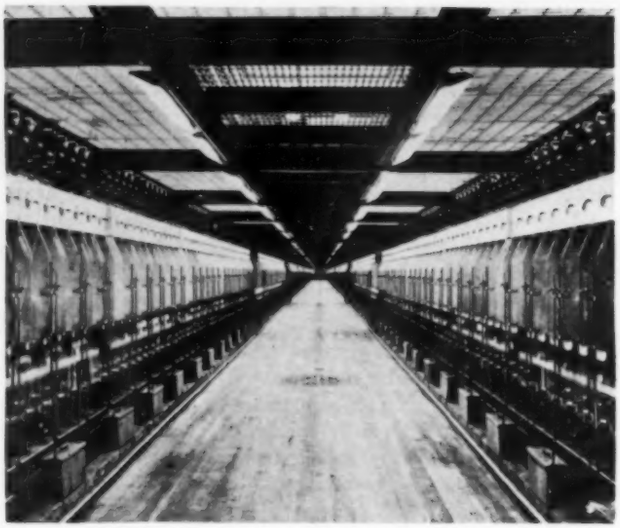
Jacketed crystallizing tanks of aluminum were being attacked by unrecirculated cooling water containing chlorides and solids. Zinc strips attached to jacket walls protect the tank

Condenser has operated without tube replacements for a period several times longer than the former interval between tube replacements indicating cathodic protection has been effective





These insulated tanks are used for processing hot rosin-brine emulsions. Cathodic protection of the tank bottoms by zinc attachments has proved highly effective in prolonging the useful life of the aluminum tanks



Rows of continuous spinning and processing machines at the Industrial Rayon Corp., Painesville, Ohio. Aluminum dryer reels, heated with inhibited hot water, are located inside each of the individual dryer boxes

num coolers was installed in order to chill a liquid product. The cooling liquid which circulated through the jackets consisted of 20 percent water and 80 percent ethyl alcohol. After two years of use, it was found that appreciable attack of the jacket walls had occurred. Laboratory tests were made which indicated that the addition of ½ ounce per gallon (1,000 p.p.m.) of potassium dichromate to the cooling liquid rendered it noncorrosive to aluminum. On the basis of these tests, a concentration of ½ ounce per gallon of potassium dichromate was maintained in the cooling liquid. Examination after two more years of service indicated that this addition had served to completely or almost completely inhibit further attack.

In another installation, hot recirculated water was passed through aluminum drying reels. This water proved to be corrosive, so that pits of appreciable depth developed in a few months. Treatment of the water with about one ounce per gallon of a saponified, naphthenic-base oil was found to inhibit attack. Soluble oil was selected as the inhibitor in this case since, in hot solutions, particularly if appreciable concentrations of chlorides are present, chromates are not satisfactory corrosion inhibitors. (L. W. Kempf and N. W. Daugherty —Reports to Aluminum Assoc., July and November, 1938. See also *Automotive Industries*, Vol. *81*, p. 156, 1939.)

The inhibiting action of silicates was pointed out by Seligman and Williams (R. Seligman and P. Williams—*Jl. Inst. Metals*, Vol. *28*, p. 297, 1922) some years ago. At the present time, silicates are of most value for inhibiting alkaline detergents, tooth paste, shaving cream, and the like, where the toxicity of chromates would be undesirable. since silicates are not as powerful inhibitors as the chromates, they are not normally used unless some of the other properties of the chromates would be objectionable. Silicates with high SiO_2 to Na_2O ratios (two or above) are better inhibitors than are the more alkaline silicates.

In solutions of the mineral acids, chromates may serve to stimulate attack, instead of retarding it. (L. J. Benson and R. B. Mears—*Chem. & Met.*, Vol. *49*, p. 88, 1942.) However, certain organic compounds, such as acridine and dibenzyl sulphide, have proved to be effective inhibitors in such solutions. Inhibitor efficiencies of up to 97 percent have been obtained in dilute hydrochloric or phosphoric acid solutions. (Unpublished work at the Aluminum Research Laboratories by G. G. Eldredge.) In special cases, other inhibitors have also proved useful.

PROTECTIVE COATINGS

The use of organic coatings to prevent attack of aluminum has been common in certain industries. In the rayon industry, such coatings are widely used on spools and buckets, while in the foods and drugs industries coatings are applied to collapsible tubes and foil wrappers. Many aluminum structures, including some of those exposed to sea water, are painted. (For suitable methods see R. I. Wray—*Aviation*, October, 1941.)

A large number of coating materials are available, and no attempt will be made to discuss their characteristics and fields of usefulness in detail. The most generally useful coatings for applications requiring the maximum chemical resistance and mechanical durability are the baked phenolic resins. These have been widely used in applications involving severe chemical exposure.

Recently, because of the difficulty of replacing aluminum equipment, these coatings have been applied to parts for which protection was not previously considered necessary, in order to extend the service life of the present equipment. Typical of these cases is a corrugated aluminum cylinder which was being slowly attacked by the dilute sulphuric acid with which it comes into contact during use. Six coats of phenolic resin are now being applied to these parts. The coating has proved very satisfactory in preventing attack.

The life of such coatings depends largely on the amount of mechanical abuse to which they are subjected. Rayon spools and buckets which are frequently and roughly handled may require recoating after only 15 or 18 months of service. In other cases, such as piping, where no mechanical abuse is involved, the life of the coating is indefinite.

The use of these coatings on aluminum has been limited largely to rather small pieces of equipment, which can be handled readily in paint shops with ordinary facilities. They

have, however, been applied to large tanks and other equipment of steel and there appears to be no reason why the methods of application developed for large steel tanks would not be equally effective in the case of aluminum equipment. Several companies specialize in the application of coatings to large equipment which is already installed.

The maximum temperature to which baked phenolic resins may be exposed continuously is about 350 or 375 deg. F. Their use in contact with strong oxidizing agents, such as nitric acid, is not recommended. They are, however, resistant to other inorganic and organic acids and to weak and moderately strong alkalis.

In the case of equipment which is already corroded, particular attention must be given the problem of removing completely all corrosion products, either chemically or mechanically. Proper cleaning and preparation of the surface is of extreme importance as the degree of adhesion of the coating is determined almost entirely by the condition of the surface.

It is believed that this method of protecting existing equipment will be most useful in cases in which slow-to-moderate attack of the uniform solution type is occurring. This type of attack produces a surface which can be readily prepared for coating. Attack by pitting may produce a surface which is difficult to clean and coat.

CLEANING METHODS

Periodic cleaning of aluminum equipment will sometimes greatly extend its useful life. Cleaners which have proved useful can be divided into two general classes: surface renewing cleaners and safe cleaners.

Surface renewing cleaners are those which, as a result of either physical or chemical action, remove a thin layer of the exposed metal surface along with the soil or accumulated residue. Steel wool and soap is an example of a surface renewing cleaner which depends on its abrasiveness for its beneficial action. The effectiveness of the periodic use of steel wool and soap has been described in a previous publication. (J. R. Akers and R. B. Mears—*Soap and Sanitary Chemicals*, April, 1941.) A synthetic tap water containing dissolved heavy metal salts and chlorides was boiled in aluminum alloy (3S) pans for eight hours a day. The water was poured out of one pan and the pan was dried but not cleaned every day. Another pan received similar treatment except that it was cleaned with steel wool and soap after each four hours of boiling. The uncleaned pan became perforated after boiling for 324 hours while the pan which was cleaned with steel wool and soap was in excellent condition after boiling for 1,000 hours.

While periodic cleaning with steel wool may be extremely beneficial, it is often impractical for equipment of substantial size. Suitable chemical solutions can be substituted in such cases. A series of large, aluminum vessels were being used for the batch steaming of a solid product. After each period of use, the vessels were washed out but were not cleaned in any other manner. Chlorides and both iron and copper salts were present in the wet product. Therefore, in the course of time, the interiors of the processing vessels became roughened by spots of localized attack.

Laboratory tests, simulating the conditions of service as closely as possible, indicated that periodic cleaning of the aluminum vessels with a warm solution containing 47 grams of tartaric acid and 3 grams of sodium fluoride per liter was beneficial. In fact, periodic cleaning with this solution reduced the rate of attack to less than one-third that which occurred in the absence of such cleaning.

Subsequently, two new processing vessels were installed. One was cleaned periodically with the tartaric-fluoride solution, while the other was simply rinsed out with warm water as was the usual custom. The vessels were examined after being used for 15 months, during which period the one vessel was cleaned seven times. The periodic cleaning had been of definite benefit in preventing the development of localized attack.

The beneficial effect resulting from the periodic use of surface renewing cleaners can be attributed to at least three fundamental causes. Adhering masses of material are removed from the metal surface. Such masses can set up potential differences which cause local attack—U. R. Evans—Metallic Corrosion, Passivity and Protection, p. 508, 1937, Edward Arnold & Co. (R. B. Mears and R. H. Brown—*Ind. & Eng. Chem.* Vol. *33*, p. 1001, 1941.) If heavy metal salts are present in the liquids contacting the surface of the aluminum, deposition of these metals will often occur on the aluminum surface. Heavy metal deposits thus formed will stimulate the attack on the aluminum by galvanic action. Finally, it has been demonstrated (R. B. Mears and U. R. Evans—*Trans. Faraday Soc.* Vol. *30*, p. 423, 1934; Vol. *31*, p. 538, 1935. R. B. Mears and R. H. Brown—*Ind. & Eng. Chem.* Vol. *29*, p. 1089, 1937.) that increasing the area of the metal surface which is attacked will result in a decrease in the intensity of attack. Surface renewing cleaners will remove the heavy metal deposits and also increase the area of the aluminum surface which is exposed to attack.

In contrast to the three separate functions of surface renewing cleaners, safe cleaners have only the one function. They will remove adhering masses from the aluminum surface. This may be extremely important in specific cases, although such cleaners are not of as general usefulness as are the surface renewing type.

Many types of aluminum equipment require no special servicing in order to have an indefinitely long life. In other cases, aluminum equipment may resist attack sufficiently long to be the most economical type to use, but since during the present emergency replacement is difficult or impossible, the application of special protective measures may be warranted. The methods described in the present paper include cathodic protection, protective coatings, chemical inhibitors, and periodic cleaning. In certain cases, two or more of these protective measures can be combined with advantage.

Corrugated aluminum cylinder protected from the action of sulphuric acid by a baked phenolic resin coating

Prolonging Life of Centrifugal Pumps

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Chem. & Met. INTERPRETATION

Now that new equipment and even repair parts are becoming almost unobtainable in some industries it is essential that careful attention be given to maintenance. The author gives maintenance suggestions that have been found of value for pumps.—*Editors.*

IT IS BECOMING DAILY MORE IMPORTANT that the maintenance of process pumps be given careful consideration and study, as for some industries new machines and even repair parts are becoming almost unobtainable due to the materials shortage. "Doing with what we have" has become the order of the day to the process industry not directly expanding for war production and, "keeping them rolling" applies just as much to process pumps in these industries as it does to any other piece of war equipment. It is the purpose of this paper to outline the basic fundamentals underlying the maintenance of pumping equipment and its field repair. The two go hand-in-hand, and careful attention to the former will, in many cases, limit and in some case obviate entirely the necessity for attention to the latter. Proper maintenance will be discussed first. Since it is obvious that pumps in certain applications will require repairs, regardless of the amount of maintenance. Field repairs with suggestions as to the proper method of accomplishment will be discussed later.

The first and foremost maintenance feature that should be followed in a modern process plant is the keeping of proper records. A suggested manner of doing this is by means of card index file in which the various pumps are catalogued under their plant number and given a separate card. This card should contain at the top the following information: the plant pump number, the size, manufacturer's name and style, the serial number, the date installed and other pertinent information which will assist in the rapid location of repair part lists, manufacturer's part numbers, etc. The remainder of the card may be divided into a number of columns, the first entitled "Repair Date," second, "Part Affected," third "Remarks," and fourth "Cost". Care should be exercised in entering on the proper cards each and every maintenance or repair operation performed on the unit in question as within a short time a certain pattern of maintenance becomes apparent when such a card file is examined, and the frequency of maintenance or repair of various units, or groups of units on allied services, will become apparent. From this examination a schedule of maintenance points can be set up as regard such important items as packing, greasing or oiling, painting, gaskets replacement, bearing examination and other more or less frequent maintenance points on the pump or group of pumps; thus it may be found that a unit or group requires packing maintenance approximately once a month, greasing once every two weeks, new gaskets once every six months, and so forth. The plant schedule may then be arranged in such a fashion that the particular equipment may be shut down and thus becomes available to the maintenance men at, or before these times. They may then perform these duties under proper and unhurried conditions, resulting in the continuity of production schedules yet with proper, complete, and thorough maintenance work.

Further, examination of such a card catalogue will guide the operating and maintenance personnel as regards the quantity of repair parts required to be on hand for the units in question. As time progresses, such a card file becomes the history of maintenance, and a complete guide to the maintenance routine required. If it is viewed as a means of anticipating normal maintenance jobs before they are sorely required the index results in a reduction in repair cost, in that the parts in question receive attention before they are spoiled or worn beyond use.

The most important parts of pumping equipment requiring frequent attention and inspection are the rotating and/or reciprocating parts and the stationary parts immediately supporting them. Therefore, the parts requiring this attention on a reciprocating pump are the pistons, valves, valve gears and piston rods. Those requiring such attention on a centrifugal pump are the shaft, bearings, shaft sleeves, impeller and stuffing box. Parts requiring frequent inspection are those between which there is relative motion, such as stuffing boxes and shafts or rods, shafts and bearings, impellers and casings, pistons (rings or packing) and cylinders, and valves and their seats. Frequent and regular inspection of these places should be established, and when made will often lead to the reason for excessive maintenance or repair. When frequently inspected and the progressive deterioration of a part observed the reason for the deterioration will make itself known.

The maintenance suggestions that have been found of value as regards particular parts of pumping equipment will be delineated. However, with regard to a pump proper and its installation, the following points are almost axiomatic.

Care should be taken to assure that no piping strains are transmitted to the pump, and that the pumping mechanism is not subjected to strains in any direction. Another point is the alignment of the driven and driving units. This matter is extremely important in that very often, the couplings may be of such a size that they can readily absorb considerable misalignment and consequent thrust. However, the bearings adjacent to them may not be capable of absorbing the thrust thus transmitted by the

coupling, and serious failure of the rotating parts may result. It is of particular importance to check alignments frequently, especially if the equipment is dismantled for inspection. Also, pumping equipment should be so installed as not to be subject to shock regardless of whether it is hydraulic, mechanical or thermal.

Frequent inspection of the bearings should be followed for these are the support points for the rotating or reciprocating members, and failure is often of an insidious nature, being sudden rather than progressive. By inspection is meant the dismantling of the bearing from the machine and a careful mechanical check of its condition. All bearings should be examined for cleanliness and must be scrupulously clean when re-installed; wipers, closures or bearing guards should also be inspected at the same time as the bearing to insure their tightness and ability to keep the bearing free of foreign material. Care should be taken when re-installing bearings to be sure that their clearance does not approach or exceed any running clearances depending on the bearing sets within the pumping unit.

The most important maintenance point on process pumping equipment is the stuffing box, and if one major point is kept in mind, that the box shall be kept clean, cool and lubricated, the operator will have conquered the most important hurdle toward proper maintenance of this point.

The second major point is the proper installation of new packing. Everyone knows how to pack a pump shaft, and the methods are as varied as the claimants to this knowledge. In describing their pet methods these self-ordained experts invariably leave out the most important consideration, which however should be first on their tongues as it is next to godliness. Dirt, grit or foreign matter of any description have no place in a stuffing box—cleanliness in the repacking operation cannot be stressed too much. Packing is generally received in boxes or on spools that are carefully wrapped. It should be kept in these containers and not left open to collect everything that is flying about in the atmosphere. Once a piece of packing is dirty you cannot dust it off! Packing should be handled with clean hands, cut with a clean knife on a clean surface. A piece of newspaper makes an excellent working place to handle packing. Cutting to the proper length is not as easy as it sounds; somewhere near proper length is not good enough, and the best job is done when the packing, cut clean and square, *exactly* meets when wrapped tightly about the shaft of the pump.

The interior of the box should be inspected before packing is inserted to assure that it is clean and free of any dirt, bits of old packing, etc. The individual rings should be installed with care, their joints staggered, and each firmly pressed into place. An excellent device for insuring the proper seating of each ring of packing is a piece of pipe larger in diameter than the shaft, but smaller in this dimension than the stuffing box, and split lengthwise into halves. After each successive ring is inserted into the box, this length of pipe may be fitted about the shaft and moved inward into the box guaranteeing the firm and proper placement of the successive rings in order. If the box in question is equipped with a seal cage, the position of this piece should be checked to be sure that it is directly in connection with the entrance in the stuffing box for the sealing medium.

After the packing has been properly installed as described above, the gland should be pulled up evenly with a wrench until it is tight and snug. The gland nuts should then be backed off until the gland is free and then taken up just finger tight. The stuffing box should then be constantly observed for the next 24 hours or so and each time an excessive leakage is observed a sixth or third of a turn on the gland nuts should be taken. This method will avoid excessive pressure on the packing during this critical portion of its life and the result will be that the lubricant will not melt out of the packing, and no charring (with consequent scoring of the shaft or sleeve) will occur. Proper attention during this "run-in" period pays dividends in the form of greater packing life and enhanced life of the shaft or shaft sleeve.

After this initial period the following remarks may be used as guidance. Stuffing box glands should not run while tight, and stuffing boxes should not be run while warm. It should be kept in mind that the average packing if run while dry, hot and tightly compressed against the shaft, becomes nothing more than a brakeshoe, therefore, this kind of operation should be avoided wherever possible. If other than a clear, non-corrosive liquid is handled by the pump in question (and with such liquids, the stuffing should drip as the fluid pumped becomes the lubricating medium between the packing and the shaft) an independent source of bland fluid should be supplied to

PUMP MAINTENANCE CARD

_____ PUMP NO.		_____ MANUFACTURER	
_____ SIZE		_____ MFGR'S ADDRESS	
_____ DATE INSTALLED	_____	"	SERIAL NO.
_____ LOCATION	_____	"	STYLE

DATE	PART	REMARKS	COST

the stuffing box to form the lubricating medium between the packing and the shaft. An extention of remarks under this subject will be found in an article entitled "Centrifugal Pumps In Process Use" by A. T. Nielsen, *Chem. & Met.*, p. 90-92, March, 1942.

It is imperative that the rotating shaft of a centrifugal pump run true in the stuffing box. If it is found that it is not possible to hold packing in such a pump for a reasonable length of time, eccentric rotation of the shaft or sleeve in the stuffing box should be suspected and corrected. The average centrifugal process pump uses non-resilient packing which cannot tolerate more than about two thousandths of an inch eccentricity, or out of roundness, at this point.

Impellers in centrifugal pumps are perhaps the most important of the rotating parts from a maintenance and observational standpoint. The maintenance consists of frequent inspection to insure that the impeller is free of obstruction, properly located and in reasonable balance.

COUPLING COVER

Couplings on pumping machinery are most generally selected by the manufacturer and are ample for the power to be transmitted. They are generally rugged and their care is a simple matter. However, for process pumps, it has been found that an important contribution can be made to the maintenance of the coupling if it is covered with a boot of some impervious material. A piece of old inner tube, canvas well impregnated with oil or paint, or some similar sheeting can be tied over the coupling to protect it from corrosive vapors and drips. This often enhances the life of the coupling buffers and other parts considerably and adds very little to dismantling time.

The frame, baseplate, and supporting parts of a pump are as important as the rotating and working parts and should be regularly inspected, washed and painted to prevent deterioration due to corrosion. Care should be taken that stuffing box drips and/or other drips, or washings do not contact these parts for long periods. These drips should be carefully piped away in order that hidden corrosion underneath the frame and baseplate do not proceed to the point that these parts may be rendered useless. In this connection, it is important to state that one of the prime maintenance features in any plant is good housekeeping. Small defects and unwanted operational faults become more apparent when the equipment is clean.

Pistons, liners, valves and stuffing boxes of reciprocating pumps are the parts requiring most frequent inspection. These moving parts all operate in a lineal direction and visual observation should assure that they do so. If they do not, the fault should be corrected as a rod or valve not stroking or lifting lineally concentrates stresses or wear on small portions of itself resulting in rapid failure of the part.

FREQUENT OILING

Oiling and greasing should be done frequently with the proper grades of lubricants and at intervals recommended by the manufacturer of the particular parts.

Field repairs depend more or less on the ingenuity of the maintenance engineer, the material to be repaired, the method, and materials available for repair work. It is important that if a repair is contemplated that inspection reveal the deterioration of the part before it has proceeded to a point where such field repairs are not possible. This applies especially to such parts as impellers on centrifugal pumps. Their state should not be such that the vanes and shrouds are worn or corroded so thin that their original contour cannot be followed and reproduced. Building up such parts by welding, metal spraying or brazing is not excessively difficult. The part should then be ground or filed to approximate its original shape. It is not to be expected that such a part will perform as efficiently or as well as a new part built by the original maker, but many instances of repairs by this means have given good accounts of themselves.

Pump parts often become worn to an inoperative state when better than three-quarters of the base metal is still in existence. Care should be exercised to repair a part with a metal of similar chemical composition in order that galvanic corrosion, when handling even mild electrolytes, will not result from the use of dissimilar metals. Long, slender parts, such as shafts and rods when welded or sprayed should be rigidly supported, and uniformally heated and cooled in order that warping will not take place. They should be carefully checked for concentricity and straightness before reinstallation. For emergency repairs paints and enamels should not be scorned as stop-gap measures for pump interiors, neither should such old standbys as Smooth-on and other repair preparations be scorned.

As regards substitution of materials, there are thousands of pumps in operation today which were originally supplied with bronze trim or were fully bronze fitted for which iron parts may be substituted with little or no change in length of service. Similarly carbon steel (hardened or not as the case may require) will be found excellent as a replacement material for many parts formerly constructed of stainless or chromium steel. These are perhaps the two main substitutions required in pumping equipment and apply of course only where the original materials were not selected for their resistance to a particular corrosive agent in the material handled. It is difficult to make further general statements as regard substitutions for in many cases the physical properties of the original material were taken into account when the part was designed. And although a particular substitute may have chemical characteristics such as to render it an adequate replacement its physical properties may be such that a part made of it might not bear the mechanical stresses imposed upon it in service. Where it is difficult or impossible to obtain a replacement part of the original material, the best procedure is to present the problem to the manufacturer of the equipment with a full statement as to the services the equipment is performing. More likely than not, because of his wide experience with his particular machines he will be able to suggest an obtainable substitute material which will perform with reasonable effectiveness.

EXCESSIVE SPEEDS

As a final suggestion, in these days when production is the cry, pumping equipment should not be driven to its utmost. Nor should manufacturer's speeds or pressures be exceeded since many stresses increase as exponential functions of these variables.

Care and attention, periodic and frequent inspection, should be the motto for the pump user today, and each piece of equipment should be looked upon as being irreplaceable and treated as such. When in doubt about a proposed method of repair, or a new service for a pump, consult the manufacturer. He will be only too glad to give information, because anything you can do today to keep your equipment running without replacement will very likely mean an increased production of important war material in the fabricator's plant.

Thermit—Its Uses in War and Industry

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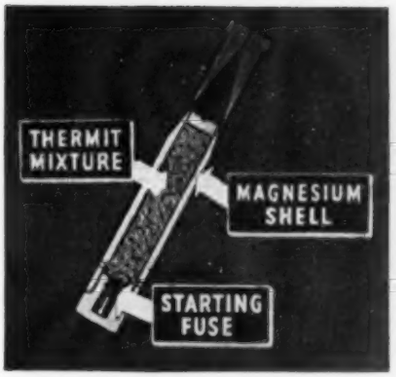
Chem. & Met. INTERPRETATION

The intense heat generated by the thermit reaction—computed to be over 5,000 deg. F.—well serves the ends of both war and peace. The magnesium-thermit incendiary bomb developed by the German, Goldschmidt, during the closing months of the first World War has become the principal article of foreign trade between Germany and England. Mr. Deppler describes this product in detail and outlines the approved methods for handling such incendiaries. Likewise he reviews the wide range of industrial applications that make use of the thermit reaction in welding for repair and new construction and in producing carbon-free metals and alloys. —*Editors.*



Cross section of small magnesium incendiary commonly used in this war

UNTIL LATELY the word "thermit" appeared only in the lexicon of the chemical and metallurgical engineers. But now that thermit has become an instrument of war, more and more people are familiar with it, although it is doubtful if any but the student of alumino-thermics has a real grasp of all of its present applications.

The high temperatures of the thermit reaction are used for welding, in repair and in new construction work. The thermit process is utilized to produce carbide-free metals and alloys. Thermit is used alone and as a priming charge in the manufacture of incendiaries of different types. And there are many other applications still to be explored.

The science of alumino-thermics is based on the long-known fact that aluminum has a great affinity for oxygen. Even half a century ago this principle was the basis of a method of reducing a number of metals from their respective oxides. But the difficulty that existed then was that metallurgists assumed that it was necessary to heat their thermit mixtures until the reaction took place, since even finely divided aluminum will not burn at a temperature much below that of molten cast iron. The results were initial temperatures so high at the moment of ignition as to produce explosive reactions.

This light magnesium incendiary weighs only about two pounds

The discovery that a cold mixture of metallic oxide and finely divided aluminum could be ignited at one spot and that the reaction of this spot would furnish enough heat to propagate the reaction throughout the entire mass furnished science with the means of safely controlling the process. This was in 1895 or 1896.

An initial temperature of about 1150 deg. C. or 2100 deg. F. is needed to start the reaction. Once this temperature is provided, the aluminum, granular in form, burns in the oxygen supplied by the metallic oxide until it is consumed, leaving a molten slag of aluminum oxide over a bath of superheated molten metal. The temperature resulting from the reaction is computed to be over 5000 deg. F.

To start the reaction, an ignition powder, composed largely of some oxidizing agent such as barium peroxide, is employed. This may be ignited with a match, by a fuse, or, if in a bomb, by the flash of a fulminate cap or black or smokeless powder. The reaction is non-explosive and relatively slow, requiring about 30 seconds, and it proceeds throughout

Thermit reaction in welding heavy crankshaft

the entire mass up to a ton or more of material.

Incendiaries.—It was a German, Goldschmidt, who, while he was attempting to reduce chromium and manganese, discovered how to ignite thermit safely. His countrymen later applied this knowledge of alumino-thermics to the design of a magnesium-thermit incendiary bomb during the closing months of the first World War. Ludendorff, in his memoirs, reports that a number of incendiaries of this type were ready for use in 1918, but that the German High Command, knowing the conflict was nearing its end, did not order their use, fearing that thereby more severe peace terms might be imposed upon the German nation.

The modern magnesium-thermit incendiary used by Axis bombers on British and European cities has been described many times. The most common size weighs one kilogram or 2.2 pounds. It consists of a tube of magnesium alloy filled with a firmly packed thermit mixture, and fitted with tail fins and a firing mechanism. Since it was manufactured by the Griesheim-Elektron company, it sometimes is known as the Elektron bomb.

The bomb ignites on impact, a pin being driven into a firing cap that sets fire to a starting charge which in turn ignites the thermit. The temperature of the thermit reaction is more than sufficient to ignite the magnesium alloy tube which constitutes the body of the bomb. The high temperature generated by the thermit reaction within the tube builds up considerable pressure so that bits of molten metal, flame, and smoke are forced out of the vent holes. But this reaction continues only for about three minutes, and thereafter the magnesium burns with less vigor at a temperature of about 2300 deg. F. for fifteen minutes or more if undisturbed. A certain number of the bombs, called "discouragers," contain a light explosive charge that will go off during the thermit reaction.

Burning magnesium's ability to extract oxygen even from water is turned to advantage in disposing of bombs of this type. A spray of water directed on the bomb speeds up the rate of combustion so that the bomb will be consumed in about two minutes. If a solid stream of water is applied to the bomb, however, it will cause such an ebullient action as to spread the fire.

Thermit is used also in the petroleum type of incendiary to provide ignition. Inexpensive grades of oil with high flash points can thus be used. To prevent the petroleum from being scattered on impact, it is mixed with soap to form a wax-like solid. Metallic sodium or potassium may be mixed with the petroleum when attacks are made on waterfront objectives, because the vigorous reaction of these solids with water will ignite the oil. Petroleum bombs are generally of large size. Some of those dropped on London produced pillars of fire rising 30 feet in the air and 12 feet in diameter.

Thermit alone, in a steel bomb case fitted with tail fins and a firing mechanism, is reported to be a type of incendiary used by Japan. These are said to weigh 15 and 50 kilograms, and would have considerable penetration power. This type of bomb also ignites on impact and may contain an explosive charge. The thermit reaction, which transforms the metallic oxide and all the steel parts of the bomb into molten metal, is completed in about 30 seconds, and it is the great heat of this metal that carries the threat of fire.

The Chemical Warfare Service recommends, if there is a chance to minimize the incendiary effect of the molten metal, that a spray of water be directed onto it to cool it as quickly as possible below the ignition temperature of the combustible material with which it comes into contact.

There is a demonstration of the thermit reaction often made of late in training classes for civilian defense workers. A small quantity of a thermit mixture is placed in a paper cup and suspended above a container of water. A few inches below the level of the water a metal plate is suspended and at the bottom of the container is a layer of sand. The thermit is ignited with a starting mixture, and of course, it falls into the water and burns through the metal plate, dropping to the sand at the bottom of the container, where it glows briefly and causes the water to boil and bubble. This demonstration shows that thermit "even burns under water." The thermit reaction is practically completed when the residue of molten iron and slag burns through the metal plate, and what the spectator sees at the bottom of the container is the cooling metal.

The effect of thermit on ordinary carbonaceous material is not as positive as on steel. When burning on wood, for example, a layer of carbon forms under the molten iron, which serves to insulate the area below the hot iron against further burning. Thus, if a crucible is made on a 2-inch plank, and filled with thermit, the chances are that the thermit will not burn through the plank. But under the same circumstances, it would burn cleanly through a 1-inch steel plate.

For Welding.—Thermit, as employed for welding, is a mechanical mixture of finely divided aluminum and iron oxide in the form of magnetic iron scale. The proportions are, roughly, three pounds of iron scale to one of aluminum. This mixture reacts according to the equation:

$$8\ Al + 3\ Fe_3O_4 = 9\ Fe + 4\ Al_2O_3$$

Thus, expressed in weights, approximately three parts of iron oxide plus one part of aluminum will produce, when reacted, two parts of steel, and the steel produced by the reaction represents about one-half of the original quantity of thermit by weight and one-third by volume. The temperature resulting from the reaction is, as has been stated, over 5000 deg. F., but because of the chilling action of the crucible, the temperature of the liquid steel as poured into the mold for welding is slightly lower although still about twice as hot as ordinary molten steel.

Actual thermit mixtures used for welding contain materials other than aluminum and iron oxide. In designing such mixtures, many variables controlling both the time and the temperature of the reaction, as well as the required chemical analyses of the resultant weld metals, are taken into account. The time and temperature of the reaction can be varied

somewhat by varying the size of the particles of the metallic oxide. Through the addition of metallic elements, either by means of metallic pieces which are melted during the reaction, or in the form of combinations of oxides of elements and aluminum, a wide variation in the analyses of thermit-made steels is provided. Table I gives the chemical formulae of the aluminum reductions of a number of oxides:

By the same means, tensile strength, ductility and hardness of the resultant steel are also controlled, and the range of physical properties made possible includes tensile strengths from 50,000 lb. per sq. in. up to 110,000 lb. per sq. in., with corresponding ductilities ranging up to more than 25 percent in the two inches.

The average analysis of thermit steel employed for welding is as follows in percentages:

Carbon	0.20 to .30
Manganese	.50 to .60
Silicon	.25 to .50
Sulphur	.03 to .04
Phosphorus	.03 to .04
Aluminum	.07 to .18

A thermit weld of this composition has an average tensile strength of about 65,000-70,000 lb. per sq. in. with an elastic limit of about 34,000-38,000 lb.; in fact, although cast, thermit weld metal may be regarded as actually having physical properties closely approaching those of forged steel.

The most commonly used thermits for welding ferrous metals are: *Plain thermit*—a mixture of finely divided aluminum and iron oxide, which is the basis for all thermit mixtures. *Forging thermit* — which is plain thermit with additions of manganese steel and mild steel punchings, and is used in welding parts made of forged steel. *Cast-iron thermit*—consisting of plain thermit with additions of ferro-silicon and mild steel punchings, used for welding cast iron. *Wabbler Thermit*—designed to produce a hard, machinable steel for building up worn wabbler ends of rolls and pinions in steel mills and similar applications.

WELDING METHODS

There are two methods of thermit welding. In the first, or pressure method, only the heat of the slag and the heat of the metal resulting from the reaction are utilized. In the second, or fusion welding, which is more widely employed, the thermit steel is deposited as weld metal.

In making a weld by the latter method, the first step is the lining up of the parts and the cutting of a parallel-sided gap at the point where the weld is to be made, the width of the gap depending upon the size of the section. Around the gap a wax pattern is formed and a refractory sand mold is built, which provides an annular space at the weld. The parts to be welded are then preheated to burn out the wax of the pattern and to dry out the mold. The thermit is placed in a specially designed crucible, and, when the reaction is complete, the crucible is tapped, allowing the thermit steel to run down into the mold. This steel, having 100 percent superheat, and being held in place by the mold between and around the ends of the part to be welded, gives up its superheat to these parts and fuses with them so that, upon cooling, a perfect fusion weld is provided.

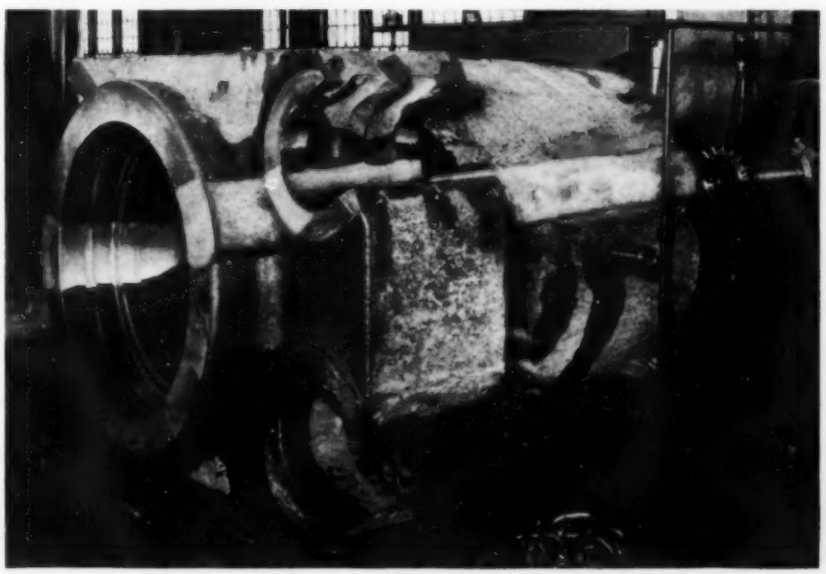
Most thermit welds in crankshafts, stern frames of ships, and machine parts are made in this way. In rail welding, however, which involves the making of a large number of identical welds, molds are made on standard patterns conforming to the sections of the rail being welded, and the making of wax patterns is dispensed with.

Theoretically, there is no limit to the size of the section which may be welded by the thermit process. This is because the weld metal is deposited in bulk and all at one time. Cooling is at a uniform rate so there is only

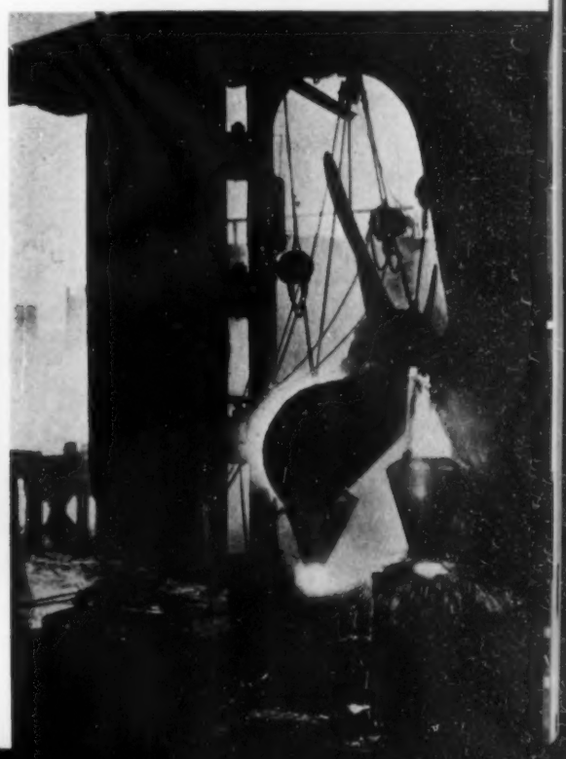
Table I.—Typical Thermit Reduction of Metallic Oxides

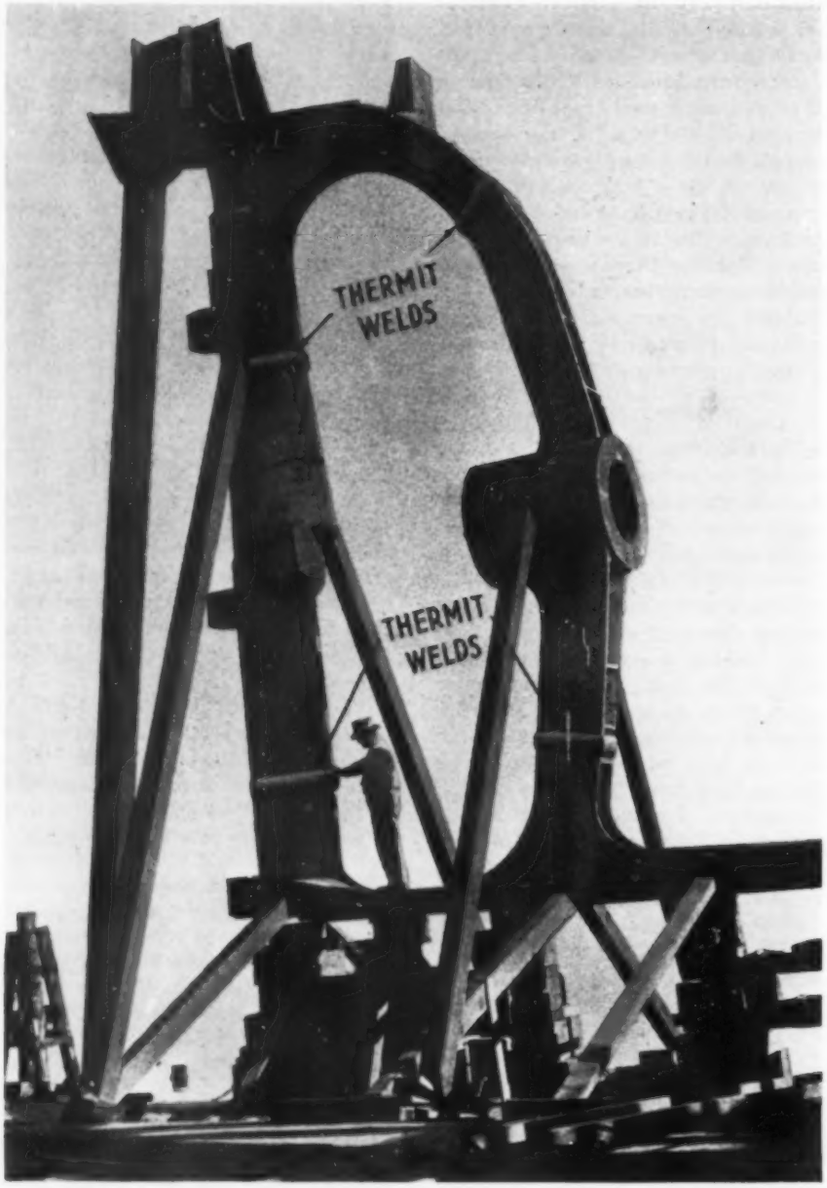
Metallic Oxides		*Aluminum*		*Resultant Slag*		*Resultant Metal*
$3Fe_3O_4$	+	8Al	=	$4Al_2O_3$	+	9Fe
Fe_2O_3	+	2Al	=	Al_2O_3	+	2Fe
$3Mn_3O_4$	+	8Al	=	$4Al_2O_3$	+	9Mn
Cr_2O_3	+	2Al	=	Al_2O_3	+	2Cr
WO_3	+	2Al	=	Al_2O_3	+	W
$3V_2O_5$	+	10Al	=	$5Al_2O_3$	+	6V
$3TiO_2$	+	4Al	=	$2Al_2O_3$	+	3Ti
3NiO	+	2Al	=	Al_2O_3	+	3Ni
MoO_3	+	2Al	=	Al_2O_3	+	Mo
$3SiO_2$	+	4Al	=	$2Al_2O_3$	+	3Si
B_2O_3	+	2Al	=	Al_2O_3	+	2B
$3Co_3O_4$	+	8Al	=	$4Al_2O_3$	+	9Co

This 25-ton hydraulic cylinder used in a rubber factory was repaired by thermit welding after serious rupture



Shipyards have long used thermit welding in repair and original fabrication





Welding together several small castings speeds construction of intricate equipment

one shrinkage in the entire weld. Local stresses are not present in correctly made welds.

The thermit reaction is used to produce carbide-free metals and alloys utilized by non-ferrous foundries and by makers of alloy steels. Such materials, produced by aluminum reduction, rather than carbon reduction, are quite pure and the absence of carbides is a distinct advantage in many applications. Shortages of aluminum, however, have somewhat restricted the use of this process.

In these ways, thermit serves the ends of both war and peace. Specialists working in the field of alumino-thermics agree that its use for many new applications awaits upon only the opportunities to explore and perfect them.

Education Looks to The Future

In his address at the dedication of the new building of Northwestern Technological Institute in Evanston, Ill. on June 16, President Karl T. Compton of the Massachusetts Institute of Technology predicted that engineering education will continue to grow into new fields of application with different techniques and methods of approach. He suggested that the trend in chemical engineering education might well prove a pattern to be studied by other branches of the profession. His remarks in that connection are given in the following paragraphs.—Editor.

FUTURE IMPROVEMENTS in engineering education may well be expected to follow along a path which was laid out by the chemical engineers. In the earlier days of this subject, training in chemical engineering consisted in the study of a great variety of standard processes of chemical manufacture, procedures like the Solvay process, or the LeBlanc process, or the Bessemer process.

Just about a generation ago a very important improvement was made in chemical engineering education. Attention was focussed on the various typical operations which were common to many types of chemical manufacture,—operations such as evaporation, distillation, transfer of heat, mixing, grinding, flow of liquids through pipes, etc. By studying thoroughly the basic theory of such operations and the techniques for handling them, the student became equipped with a method for tackling the various units which together form a manufacturing process, with a thorough knowledge of how and why they operate, but without having his mind cluttered up with the details of this or that particular chemical or material. This new concept of engineering education in the field of chemical manufacture was instantaneously successful and has resulted in chemical engineering's becoming one of the most useful and active of all engineering professional fields.

Thermit welding was used in fabricating frame of world's largest freight car

Maintenance Tips For Engineers

HOW TO KEEP MOTORS RUNNING AND AVOID LOST OUTPUT THROUGH MAINTENANCE

O. F. VEA *Motor Division, General Electric Co., Schenectady, N. Y.*

CHEM & MET PLANT NOTEBOOK

PRESENT-DAY conditions make it necessary that all electric motors be babied. Maintenance programs must be intensified to prevent breakdowns, because 24-hour-a-day, 7-day-a-week war production schedules cannot be interrupted—output lost today cannot be made up tomorrow. Even the failure of an inconspicuous piece of equipment can cause a considerable disruption in production.

A real maintenance program begins with selection. Motors must be chosen that are properly rated and protected for their work. The selection involves a study of requirements, such as continuous or intermittent duty, starting, torque, speed regulation, and the like. These all have a bearing on just what type of motor to choose.

In addition, the environment in which the motor is to operate should be considered, as this determines whether an open motor or some form of inclosed motor should be used, and how the motor should be located with respect to the driven load.

The next point to be considered is installation. The motor should be located in such a way that it is accessible for inspection and repairs. Of course, it is always advisable to install the motor in a place free from adverse conditions unless it is built in a protecting inclosure. It is also important to see that the motor has ample ventilation so that heat losses will be carried away.

A standard motor should not be installed where the ambient temperature or normal temperature rise is more than 40 deg. C. The motor should be installed on a solid foundation which is free from vibration. If it is direct-connected or belted, care should be taken to secure proper alignment, which should permit rotor end-play within reasonable limits.

All these factors must be taken into consideration if inspection and maintenance are not to be discouragingly difficult.

Frequency of inspection and degree of thoroughness vary, and will have to be determined by the maintenance engineer. They will be governed by (1) the importance of the motors in the production scheme (that is, if the motor fails, will the whole works be shut down?), (2) percentage of time the motor operates, (3) nature of service, (4) environment. An inspection schedule must, therefore, be elastic and adapted to the needs of each plant. The schedule tabulated here, covering both a-c and d-c motors, is based on average conditions in so far as duty and dirt are concerned.

Every Week

1. Examine commutator and brushes.
2. Check oil level in bearings.
3. See that oil rings turn with shaft.
4. See that shaft is free of oil and grease from bearings.
5. Examine starter, switch, fuses, and other controls.
6. Start motor and see that it is brought up to speed in normal time.

Every Six Months

1. Clean motor thoroughly, blowing out dirt from windings and wipe commutator and brushes.
2. Inspect commutator clamping ring.
3. Check brushes and renew any that are more than half worn.
4. Examine brush holders and clean them if dirty. Make sure that brushes ride free in the holders.
5. Check brush pressure.
6. Check brush position.
7. Drain, wash out, and renew oil in sleeve bearings.
8. Check grease in ball or roller bearings.
9. Check operating speed or speeds.
10. See that end play of shaft is normal.
11. Inspect and tighten connections on motor and control.
12. Check current input and compare with normal.
13. Run motor and examine drive critically for smooth running, absence of vibration, worn gears, chains, or belts.
14. Check motor foot bolts, end-shield bolts, pulley, coupling, gear and journal setscrews, and keys.
15. See that all motor covers, belt and gear guards are in good order, in place, and securely fastened.

Once a Year

1. Clean out and renew grease in ball or roller bearing housings.
2. Test insulation by megger.
3. Check air gap.
4. Clean out magnetic dirt that may be hanging on poles.
5. Check clearance between shaft and journal boxes of sleeve-bearing motors, to prevent operation with worn bearings.
6. Clean out undercut slots in commutator.
7. Examine connections of commutator and armature coils.
8. Inspect armature bands.

The competent maintenance man will have a record card for every motor in the plant. All repair work, with its cost, and every inspection can be entered on the record. In this way, excessive amounts of attention or expense will show up and the causes can be determined and corrected.

Inspection records will also serve as a guide to tell when motors should be replaced because of the high cost to keep them in operating condition.

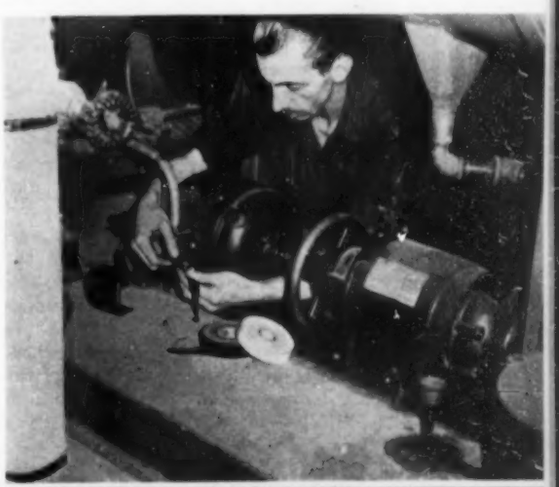
LUBRICATION

One of the major features of a maintenance program, from the standpoint of effect upon the general performance of a motor, is proper lubrication. Bearings of modern motors, whether sleeve, ball or roller, require only very infrequent attention. However, oiling and greasing of new motors is quite often entrusted to careless attendants who have been used to lubricating older designs, with housings less tight than on modern machines.

If the proper amount of a suitable lubricant is applied before starting, there should be no need to refill the housings for several months, even in dusty places.

Only a high grade of grease, having the following general characteristics, should be used for ball-bearing lubrication:

1. Consistency a little stiffer than that of vaseline, maintained over the operating-temperature range.
2. Melting point preferably over 150 deg. C.



Connections to a motor should be made tightly enough so that vibration of equipment will not loosen them. Wires joined in a conduit box should be either twisted together and soldered, or bolted together. Joints should be wrapped with rubber tape and then with friction tape

Install motors in such a way that they are accessible for inspection and repairs. Care should be taken to align the motor properly with driven load

3. Freedom from separation of oil and soap under operating and storage conditions.
4. Freedom from abrasive matter, acid, and alkali.

Specific instructions for the individual design should be followed if possible, rather than general rules.

In motors equipped for the pressure-relief method of greasing, greasing tends to purge the bearing housing of used grease. Complete cleaning of bearings, therefore, is required at infrequent intervals only. Carbon tetrachloride or other grease solvent is suitable for a thorough and convenient flushing when the bearings are not disassembled.

INSULATION CARE

Care of insulation goes hand in hand with lubrication as one of the major features of a motor maintenance program. These features concern the most vital, and probably the most vulnerable, parts of a motor.

Motors that have been long in transit in a moist atmosphere, or idle for an extended period, should be thoroughly dried out before being placed in service. Since machines sometimes "sweat" as a result of a difference in their temperature and that of the surrounding air, they should be kept warm at all times to prevent this condition.

Current at a low voltage can be passed through the windings, electric heaters can be used, or even steam pipes can be utilized for protective purposes. In the case of extended idle periods, tarpaulins may be stretched over the motor and a small heater put inside to maintain proper temperature.

The most effective method of drying out motors that have become wet by accident or because of "sweating" is to pass current through the windings, using a voltage low enough to be safe for the winding in its moist condition.

Thermometers should be placed on the windings to see that they are heated uniformly. Temperatures should not exceed 90 deg. C. (Class A insulation). This method is particularly effective on high-voltage motors, where the insulation is comparatively thick.

The time required for complete drying-out depends considerably on the size and voltage of the motor. Insulation resistance measurements should be taken at intervals of four or five hours until a fairly constant value is reached. These tests are a good indication of the general condition of the insulation and its ability to stand the operating voltage.

Insulation resistance tests should also be made before a high-potential test, to determine whether the insulation is ready for such a test, and afterwards to make certain that the high potential has not injured the insulation. High potential tests should be made after drying out or after repairs to check the dielectric strength of the insulation.

New windings should successfully stand a high-potential test of twice normal voltage plus 1,000. Motors that have been in operation for some time should be tested with this method, *after thorough cleaning and drying*, using a voltage of about 150 percent of normal voltage, applied for one minute.

CLEANING MOTORS

A systematic and periodic cleaning of motors is necessary to insure best operation. If conditions are severe, open motors may require a certain amount of cleaning each day. For less severe conditions, weekly inspection and partial cleaning are desirable.

For the weekly cleaning, the motor should be blown out with dry compressed air (about 25 to 30 lb. per sq. in. pressure). Where conducting and abrasive dusts are present, even lower pressure may be necessary, and suction is to be preferred, as damage can easily be caused by blowing the dust and metal chips into the insulation. On larger d-c machines, the air ducts should be blown out so that the ventilating air can pass through as intended.

In cleaning a motor, the heavy dirt and grease should first be removed with a heavy, stiff brush, wooden or fiber scrapers, and cloths. Grease, oil, and sticky dirt are easily removed by applying a cleaning liquid such as carbon tetrachloride, gasoline, or naphtha, preferably by spraying it on. While the insulation will dry quickly at ordinary room temperature after cleaning, it is highly desirable to heat it to drive off all moisture before applying varnish. If the motor can be spared from service long enough, the insulation should be dried out by heating to from 90 to 100 deg. C.

While the motor is warm, a high-grade insulating varnish should be applied. For severe acid, alkali, or moisture conditions where oil or dusts are present, special varnishes can be supplied. If the machine must be put back in service quickly, or if facilities are not available for baking the varnish, fairly good results will be obtained by applying one of the quick-drying black or clear varnishes.

GENERAL OVERHAULING

Motors should usually be given an overhauling at intervals of five years or so, normally, or, if the service is more severe, more frequently. Such a practice is beneficial in avoiding breakdowns and in extending the useful life of the equipment. Where periodic overhauling is practiced, the following notes may be helpful.

Check the motor air gap, between stator and rotor, with feelers for uniformity. Small clearance at the bottom may indicate worn bearings.

Take the motor apart and inspect it thoroughly. Measurement of the bearings and journals may indicate need for new bearing linings. Remove the waste from waste-packed bearings and rearrange or replace it, so that any glaze on the wool is removed from its point of contact with the shaft. Any gummy deposit means that the wool should be replaced. All lubricant should be cleaned out of the bearings and a fresh supply put in when the motor is reassembled.

The rotors should be cleaned with a solvent to remove any accumulated dirt, after which any rust should be removed with fine sandpaper (not emery paper). When clean and dry, the rotors should be coated with a good grade of clear varnish or lacquer to protect them from moisture. To prevent injury to the bearings, they should be completely protected with a clean rag when the motor is disassembled.

The rotors of wound-rotor motors should be given the same treatment as the stators. In addition, soldered joints and binding cords should be inspected and any weakness remedied.

The stator bore should be cleaned of dirt with a solvent, and any rust should be removed with fine sandpaper (not emery paper).

D-C MOTORS

To insure efficient operation of d-c motors, inspection and servicing should be done systematically. The first essential for satisfactory operation of brushes is free movement of the brushes in their holders. Uniform brush pressure is necessary to assure equal current distribution. Make sure that each brush surface in contact with the commutator has the polished finish that indicates good contact, and that the polish covers all of this surface of the brush. Check the freedom of motion of each brush in the brush holder.

When replacing a brush, be sure to put it in the same brush holder and in its original position. When installing new brushes, fit them carefully to the commutator. To do this, insert a strip of fine sandpaper, sand side up, between the commutator and the brush. Rotate the commutator back and forth, allowing the brushes to bear on the sandpaper only when the commutator is moving in the proper direction of rotation. Then check the springs that hold the brushes against the commutator. Improper spring pressure may lead to commutator wear and excessive sparking.

Inspect the commutator for color and conditon. It should be clean, smooth, and a polished-brown color where the brushes ride on it. A bluish color indicates overheating of the commutator. Roughness of the commutator should be removed by sandpapering or stoning. Never use emery cloth or an emery stone. For this operation, run the motor without load. If the armature is very rough it should be taken out and the commutator turned down in a lathe. When this is done, it is usually necessary to cut back the insulation between the commutator bars slightly. After turning down the commutator, the brushes should be sanded and run in as described previously.

CHEM & MET REPORT ON

War-Time Construction in Chemical Process Industries

War has added many burdens on backs of the industries that are building war plants. Unfortunately, these burdens must be carried by Industry for it is Industry not W.P.B. or any other governmental agency that has this job to do. And, more specifically, it is the responsibility of the individual industry that undertakes war work to get its job done in spite of hell, high water and red tape. So this report has been prepared to help clear the way for action by suggesting procedures and short-cuts, and by answering some of the questions being asked us most often by chemical engineers, manufacturers and equipment fabricators. We have been told, for example, that there is going to be a lull in the construction program. But does that mean that essential plant construction should stop? Does W.P.B. or any other agency really believe that no more productive capacity is needed now? We think *not*. What it really means is that some things like synthetic rubber, 100-octane gasoline and chemical warfare materials, for example, may be needed more than some other things so that, if necessary, more capacity of otherwise essential war materials may have to be delayed. This is a challenge as well as a real opportunity for the chemical engineer. The pages that follow should help him meet that challenge.

CHEMICAL AND METALLURGICAL ENGINEERING · JULY, 1942

War-Time Construction in Chemical Process Industries

SUMMARY AND CONCLUSIONS

Three recent governmental regulations vitally affect new plant construction in the chemical process industries. First in importance, perhaps, is the "Directive for War-Time Construction" dated May 20, which sets up seven basic criteria that must be met before any project can be approved. Second, is the List of Prohibited Items which says, in effect, that no building can be done unless the raw materials to be consumed are less critical than the final product. Third is Conservation Order L-41 prohibiting the start of all *unauthorized* construction projects that exceed certain maximum costs,—$5,000 per year in the case of industrial buildings.

Despite these burdensome regulations, there are still many new plant projects in the chemical engineering field that must be pushed ahead intelligently and effectively during the next few months. Except for the synthetic rubber, aviation fuel and the new explosives and chemical warfare plants, these projects are generally smaller in size than the major chemical expansion programs that have already been completed or are still under way. But they are extremely important in order to remove bottlenecks in existing plants and to provide essential catalysts, inhibitors, plasticizers and similar ingredients.

To help in expediting this work, the Chemicals Branch of the War Production Board has set up a Project Rating Unit in the Railroad Retirement Building in Washington under the direction of Ben H. Wilcoxon, a chemical engineer of excellent training and experience. In New York, on the 54th floor of the Empire State Building, Vernon Bishop represents the Chemical Branch in the Bureau of Construction of W.P.B. Both of these men are willing and able to assist those who have pressing problems in connection with war-time construction in the chemical process industries.

The information on which the following report is based has been obtained from both public and private sources. However, all interpretations and conclusions drawn from governmental orders are those of the editors of *Chem. & Met.* who assume entire responsibility. Careful study of these new regulations and the practical suggestions offered here in connection with them should promote more intelligent progress in meeting the continuing needs of the war program.

IN THE EARLY DAYS of the national defense program, the various governmental agencies were inclined to encourage all possible plant construction which would aid directly or indirectly in the war effort. It soon became apparent, however, that this vast expansion program would have to be curtailed because of two reasons: (1) Shortages of raw materials and equipment were becoming so acute that it was almost impossible to build even A-1-a projects on schedule and (2) all possible materials and equipment should be diverted into direct military requirements.

Chemical engineers and others concerned with the problem of getting war plants built and into operation in time to be of most effective service began to run into increasing difficulties. At first it was merely a matter of getting the necessary men, money and materials. Then came priorities and the complicated maneuvering for project ratings in the case of the most essential undertakings. Gradually the controls began tightening and on April 1, 1942, the Army and Navy Munitions Board published its "List of Prohibited Items for Construction Works." And all this reached a sort of a climax April 9 with the issuance of Conservation Order L-41 which virtually put a stop to all major construction undertaken without prior governmental approval. Subsequent rulings and interpretations of L-41 made it clear that practically all industrial projects costing more than $5,000 during any continuous 12-month period could not proceed without specific governmental authorization.

Within a matter of weeks, it became apparent that L-41 was only preliminary to the real climax. This came on May 30 in the exceedingly important "Directive for War-Time Construction." Duly recommended by William H. Harrison, Director of Production for W.P.B., it carried the approving signatures of Donald M. Nelson, Chairman of W.P.B., Henry L. Stimson, Secretary of War and Frank Knox, Secretary of the Navy. Because of its basic importance as a statement of guiding principles to govern all war-time construction, this directive is reprinted herewith in its entirety.

DIRECTIVE FOR WAR-TIME CONSTRUCTION

To make available all possible material and effort for immediate war production, the following paragraphs outline the principles governing war-time construction:

1. In order that the consumption of materials and equipment by construction activities shall not impede the production of combat supplies and equipment, it is essential that all construction whether financed by the Government or other funds, be reduced to the absolute

minimum necessary for the war effort. This applies also to construction essential for vital civilian needs.

2. Reduction in the consumption of materials and equipment by construction operations can be achieved either by the elimination of non-essential projects or parts thereof, by deferring projects not needed immediately, or by appropriate changes in design and construction methods which will favor the use of those materials which are most plentiful and which will interfere least with the production of combat material.
3. In order to establish effective measures for the control of construction, the following general policies have been established by the War Production Board, in consultation with the War and Navy Departments.
4. Before any construction project can proceed, it must be acted upon affirmatively by some agency of the Federal Government or by its duly authorized representative. No project will be approved for construction unless it is found, by responsible authority, to meet the following criteria:
   (a) It is essential for the war effort.
   (b) Postponement of construction would be detrimental to the war effort.
   (c) It is not practicable to rent or convert existing facilities for the purpose.
   (d) The construction will not result in duplication or unnecessary expansion of existing plants or facilities now under construction or about to be constructed.
   (e) All possible economies have been made in the project, resulting in deletion of all non-essential items and parts.
   (f) The structure of the project has been designed of the simplest type, just sufficient to meet the minimum requirements. See Paragraphs 5 and 6 also.
   (g) The answers to the following questions relating to conditions at the proposed site are all affirmative to the extent that they are pertinent:
      (1) Are there sufficient labor and materials available to build it?
      (2) Will adequate public utilities be available without costly extensions?
      (3) Will transportation be available to serve it?
      (4) Will labor be available to man it? (Are housing and other community facilities adequate?)
      (5) Will machine tools and other equipment be available to equip it?
      (6) Will raw materials be available to operate it?
      (7) Can the manufactured product be used at once —or stored until needed?
5. *Priority of materials*—In general, all construction shall be of the cheapest, temporary character with structural stability only sufficient to meet the needs of the service which the structure is intended to fulfill during the period of its contemplated war use. Ordinarily, wood-frame construction is preferable to reinforced concrete, and reinforced concrete is preferred to steel. However, the guiding principle should always be to *utilize those materials which are most plentiful* and which, in the ultimate analysis, will cause the least interference with the production of combat material and the utilization of transportation and power.
6. Mechanical and electrical features should be reduced to bare essentials. Air conditioning may only be used where manufacturing processes make its use essential and not for the comfort or to increase efficiency of personnel. Electrical systems shall be of the simplest designs.
7. Construction materials and the end products, the use of which is prohibited by the Army and Navy Munitions Board directive, "List of Prohibited Items for Construction Works," dated April 1, 1942, and revisions thereof, shall not be specified, purchased, or used except under special waiver issued by competent authority as provided for.
8. *Enforcement* — Each department having cognizance of construction work will require its subordinate activities to comply strictly with the foregoing general policies and any extensions thereof issued by proper authority. Each department shall arrange for frequent and adequate spot checks of its projects to make sure that all subordinate agencies of the department concerned are rigorously conforming to the established policies. Furthermore, violations of these policies must be followed by proper dicipliniary action and the imposition of suitable penalties.
9. It should be made clear to all concerned that these general policies should govern not only direct construction for the War and Navy Departments but also other construction financed directly or indirectly with Government funds, and all private construction. The evasion of the requirements of the general policies by manufacturers or other parties will result in the imposition of penalties.
10. The War Production Board, the Army and the Navy shall take immediate steps to effectuate in detail this directive. It is particularly important that any governmental agency which has contact with or control of privately-owned expansions see to it that no violations of this directive occurs.

LIST OF PROHIBITED ITEMS

In order to reduce the consumption of material and equipment on approved construction projects to the absolutely essential minimum, the Directive for War-Time Construction incorporated the A.N.M.B. "List of Prohibited Items for Construction Work," dated April 1, 1942, and revisions thereof as part of the directive governing all construction. This list of prohibited items specifically includes certain permitted uses and certain prohibited uses of aluminum, asbestos, brass, bronze, burlap, cadmium, chromium, copper, cork, corkboard, granulated cork, gas, hemp, jute, lead, magnesium, mahogany, manila, mercury, Monel, nickel, oakum, plywood, rubber, silk, sisal, spruce, steel and iron, tin, tung oil, vanadium, wool and zinc.

Earlier conservation lists dealt largely with construction materials for building. However, this new list gives consideration to air conditioning, refrigerating systems, oil refining plants, power plants, material re-

Contracts for new plant construction in the Chemical Process Industries, public and private, totalled $616,309,000 for the first 6 months of 1942 as compared with $140,504,000 for same months of last year

quirement for equipment, etc. This listing is not included in this article as it is now undergoing revision, and is expected to be re-issued within a few weeks.

Provided that a proposed project has met the requirements of the two Government regulations described above, then it becomes necessary to obtain Government authorization for construction.

CONSERVATION ORDER L-41

In order to put into effect the policy set forth in the directive for war-time construction, Conservation Order L-41, dated April 9, 1942, prohibits the start of unauthorized construction projects.

The order specifically provides that no residential construction except for maintenance and repair work may be started without permission if its estimated cost is $500 or more. Similarly, no new agricultural construction may be started if the estimated cost is $1,000 or more for the particular building or project involved. No other construction, including commercial, industrial, recreational, institutional, highway, roadway, sub-surface and utilities construction, whether publicly or privately financed, may be initiated without permission if the cost of the project amounts to $5,000 or more.

In computing such costs, the amount spent on the project within 12 months of the date of beginning construction, and subsequent to April 7, 1942, is included.

Specific types of construction, however, are necessarily exempt from the provisions of the order. These include:

1. Projects which will be the property of the Army, Navy, Coast Guard Maritime Commission and certain other listed agencies of the Federal Government;
2. Projects to reconstruct or restore residential property damaged or destroyed on or after January 1, 1942, by fire, flood, tornado, earthquake or the public enemy.
3. Projects of the type restricted or controlled by provisions of the orders of the M-68 series, which cover the production and distribution of petroleum.

Where priority assistance is granted by the War Production Board, authority to commence construction will be issued by the Director of Industry Operations on appropriate forms of orders in the *P* series.

These include preference rating orders of the P-14 series, P-19 series, P-41, P-46, P-55, P-98, P-110 and P-115. (See following Appendix *A* for types of construction). Preference ratings extended on PD-1 or PD-1A forms or by any other *P* order than those listed in the L-41 order do not constitute authorization to begin construction.

In all cases of chemical projects involving building construction where the cost of the project is over $5,000 per annum, it is necessary to file Form PD-200, even though only a small number of priority ratings are required. This, of course, does not apply to maintenance or repair. As defined in L-41, maintenance means upkeep of a building, structure or project in sound working condition. Repair means the restoration, without change of design (See par. "f" below), of a building, structure or project to sound working condition, when such portion has been rendered unsafe or unfit for service by wear and tear, damage or other similar causes. In order to make the definition of repair less rigid Interpretation No. 1 of Conservation Order L-41 was issued June 6, 1942 (W.P.B. Release 1305), which reads:

(a) The term "Construction" in paragraph (a) (2) does not include the excavation or other movement of earth where no material except earth or other unprocessed material is to be incorporated.

(b) In connection with paragraphs (a) (3), (a) (4), and (a) (5), where part of a building, structure, or project falls within one class under said Order and other parts within another or other classes, the predominant designed use shall determine classification of the whole construction.

(c) In connection with paragraphs (a) (4) and (a) (5), a structure to be used primarily for the storage of farm products

Appendix A—Conservation Order L-41

The following Preference Rating Orders and Certificates are listed pursuant to paragraph (b)(7)(i) of the above Order. A general description of the type of construction covered by each, the appropriate application form and where such form should be filed are given solely for purpose of identification.

Preference Rating Order	Type of Construction	Application Forms	Where Filed
P-14-a P-14-b	Shipyards and shipways	No form	Maritime Commission Washington, D. C.
P-19 P-19-a	Buildings, structures and projects important to the war effort and essential civilian needs, other than housing	No further application accepted under P-19 and P-19-a. Apply for P-19-h or P-19-i	
P-19-d P-19-g	Publicly financed housing	Application is made only by the federal agency principally interested in the construction	———
P-19-e	Public roads	Application is made by or through the Public Roads Administrative of PWA	———
P-19-h P-19-i	Buildings, structures and projects important to the war effort and essential civilian needs other than housing	Forms PD-200 and PD-200A	With the field office of FHA having jurisdiction of the site
P-41	Construction of air transport facilities	See Order	———
P-46	Certain types of utilities construction	See Order	———
P-55 P-55 amended	Privately financed Defense housing	Form PD-105	With the field office of FHA having jurisdiction over location of the site
P-98	Construction related to Petroleum Enterprises as defined and limited therein	See Orders in M-68 series	———
P-110	Remodeling of housing in defense areas	Form PD-406	With the field office of FHA having jurisdiction over the location of the site
P-115	Expansion of Canning Plants	Form PD-285	With WPB, Washington
Certificates			
PD-3 PD-3A	Principally buildings structures and projects owned or to be owned by the Army, Navy or certain other governmental agencies	Form PD-3A	With the contracting or procurement official having jurisdiction over the contract

which are produced by a person other than the proprietor of such structure shall be interpreted to be "Other Restricted Construction."

(d) The Cost of Construction, as defined in paragraph (a) (7), shall include the Cost of an article, chattel or fixture if such article, chattel or fixture is to be (a) physically incorporated in and used as part of the construction; or (b) so substantially affixed to the construction that it may not be detached without materially injuring it or the construction.

(e) The Cost of Construction, as defined in paragraph (a) (7), shall include neither (a) the value of used material, including equipment, which has been severed from a building, structure or project and is to be used in the construction, without change in ownership; nor (b) the estimated cost of labor in incorporating such used material.

(f) The term "Without Change of Design" in paragraph (a) (9), is interpreted to permit change in material or type of equipment if the architectural or structural plan is not substantially altered in effecting such change.

(g) In determining whether the estimated cost of a particular building, structure or project exceeds the cost limits permitted under paragraphs (b) (4) (i), (b) (5) and (b) (6), over any continuous twelve-month period, the cost of any construction thereon during said period authorized under the provisions of paragraph (b) (7) shall not be included.

A literal interpretation of this order is that each integrated portion of a chemical plant is limited to $5,000 of new work other than repair and maintenance per year for each product. This would, of course, work a serious hardship on major companies in the chemical process industries which are continually making minor alterations and additions to plants, which will usually total far in excess of the $5,000 per year figure. Accordingly the administrators of L-41 are making attempts to remove this burden which would otherwise require filing numerous PD-200's for very minor projects.

Chem. & Met. is informed that until further notice is given, all projects should be filed in accordance with the following instructions:

(a) All chemical construction on which no priority assistance is required will be made on Form PD-200 in the usual fashion. The applicant should indicate that no priority assistance is required. If that is the case, these should be filed with the Construction Bureau, 54th floor, Empire State Building, New York City.

(b) All chemical construction on which priority assistance is required should be prepared on Form PD-200 in the usual fashion and sent to Washington.

PREPARING FORM PD-200

Form PD-200 was designed by W.P.B. to be a general form to cover all types of construction. Accordingly, if only the questions asked on the form are answered, it is difficult for the analysts in W.P.B., in the case of chemical plant construction, properly to evaluate the merits of the individual project and to ascertain that all possible conservation measures have been exercised in designing the plant. Further information is highly desirable. The purpose of the following suggestions is, therefore, to permit more rapid clearance of the project when filed, and to avoid the delay encountered in going back to the applicant for further information, and in redesign, which has been required in many instances. Much time can be saved by properly preparing the PD-200 and exercising conservation in design. In order to justify the project, the applicant should endeavor to answer the items covered by the following outline:

A. Present Situation

1. Present production.
2. Approximate breakdown of distribution of present production by end use where possible.

B. Objections to Present Situation

1. Why are new facilities required?
2. What would be the position of the company insofar as meeting defense requirements if project were not constructed?
3. Discuss alternate means of fulfilling defense demands.
4. What would be the effect on civilian consumption if proposed facilities were not constructed?

C. Proposal

Describe project in detail as follows:

1. Define clearly just what facilities are covered by the project.

For example:

This project includes the installation of two identical units for the production of ....., each unit consisting of equipment for the recovery of.....from..... streams, the polymerization of this .....which is then finished as ..... The required equipment consists of fractionating towers, drums, storage tanks and spheres, heat exchangers, pumps and drivers, compressors, instruments, finishing and packaging equipment, power and steam distribution facilities, sewers and drainage systems, fire protection system, roads, railroad spur, and fences. Approximately 12 buildings are involved of which five comprising approximately 7,500 sq.ft. of floor space will be of brick, steel, and concrete construction. The remaining seven buildings, comprising approximately 65,000 sq.ft. of floor space, will be of structural steel frame with corrugated asbestos roofing and siding.

2. Indicate the cost of materials as well as the total cost of the project.
3. What increase in production or improvements in operation will be effected by the proposal?
4. Include sufficient information in regard to building and structural work to indicate the type of design.
5. Include a brief sketch or flow sheet of proposed facilities so that the analysts can readily visualize the facilities which are to be constructed. Preferably, this flow sheet or sketch should show the relationship to existing facilities. In justifying the application it is particularly helpful to have a flow sheet showing the distribution and quantities required throughout the plant.
6. Where critical materials such as copper, copper alloys, aluminum, nickel and stainless steel alloys are required, the composition of alloys should be indicated and it should be stated whether solid, clad or lined construction is utilized.
7. Furnish a detailed tabulation of all buildings, process equipment, utilities, appurtenances, etc., covered by the application, breaking the items down into the necessary materials of construction *where practical.* For example: Condensers should be broken down into steel plate, tubing, etc., columns into steel plate, alloys, castings, etc. Refer to Appendix B for suggested form. Material cost should be based upon the fabricated cost of equipment delivered to plant site. Any other basis may be substituted as long as applicant so indicates and is consistent.
8. It is presumed that Item 7 will be a detailed list of all items covered by the project.
   Prepare a recapitulation of critical materials and equipment. Refer to Appendix C. The recapitulation should be particularly accurate with respect to steel plate, nickel, Monel, alloy steel, copper, copper alloys, aluminum, tin, and rubber.
9. Indicate clearly your raw material position. List all principal chemical raw materials as well as electric power required for processing after completion of the plant. It is suggested that raw materials be given in terms of pounds per pound of product. Also describe what arrangements, if any, have been made for obtaining these requirements of raw materials.

D. Justification

1. Justification of entire project. While the burden of justifying the entire project rests with the Defense Agencies, the applicant usually has readily available information which will help justify the Project.
2. Justification of process used—This is necessary only when several processes could be used, some of which are more attractive from a national point of view with respect

to the utilization of critical materials for construction and of critical chemicals as raw materials. A good example is phenol.

3. Justification of appurtenances—This applies particularly to utility systems, tankage, etc. For example, if power generating facilities are included, these should be described in detail, indicating applicant's position in event it is impossible to furnish the power generating facilities at the same time the plant is to be completed. In all cases adequate information should be furnished, showing your present power facilities and the necessity for increased capacity. In the case of tankage, instrumentation and other appurtenances, it should be established that these are designed to a minimum.
4. Justification of critical materials in construction of buildings and structural work. Refer to Appendix D for a tabulation of suggestions which will probably pass the Conservation Section of W.P.B. with a minimum of delay. If these design suggestions are being adhered to, it should be so stated in the application. If not, it is suggested that sufficient supporting information be submitted to justify any necessary deviation. In many cases blueprints or sketches of the structural work would be helpful.
5. Justfication of the use of critical materials such as copper, copper alloys, stainless steel, nickel, Monel, lead, rubber, cork, etc., in process equipment for corrosion resistance. Refer to following pages for a tabulation of design suggestions for process equipment. Wherein it is impractical to adhere to the suggestions it should be so stated and the deviations justified. Supporting data should be given to indicate the necessity of using Monel, nickel, aluminum, stainless steel. Sketches, flow diagrams, corrosion rates, temperatures, pressures, anticipated life, and all facts helpful in establishing the necessity of the materials requested should be included.

Appendix B—Suggested Form for Tabulation of Buildings, Equipment and Appurtenances

Buildings	Unit of Measures	No. of Units	Value
1 — 20′ x 80′ x 15′ high reinforced concrete building			$20,000
Structural steel	tons	40	
Process Equipment			
Furnaces			
1 — 5,000,000 B.t.u./hr 10 x 20 x 14′ furnace			$10,000
30- 18-8 C.N. Tubes	tons	4	
30- 18-8 C.N. headers	tons	1	
30- 29-19 C.N. tube supports	tons	1	
Exchangers			
Bottoms cooler			5,000
¼″ steel shell	tons	.45	
11-13% C.R. Tubes			
¾″ x 14 Ga	tons	.20	
Columns			
6′ x 60″ acetone fractionating columns			10,000
¾″ steel shell	tons	6	
C.I. bubble trays	tons	1.4	
4-6″ C.R. Monel Steel Bolting	tons	.3	
Pumps			
1-6″ GPM feed pumps. C.I. Case Steel impeller N1 resist trim			500
Reactor Vessels			
Separators			
Compressors			
Gas Holders			
Knock-out drums			
Accumulators			
Turbines			
Motors			
Instruments			
Process Piping			
Auxiliaries			
Loading Facilities	Detail as above		
R. R. Spurs			
Tankage			
Utilities			
Utility Piping			
Electric Power System			
Steam System			
Air System			
Sewer System			
Refrigeration System			
Salt Water System			
Fresh Water System			

Appendix C—Recapitulation of Critical Materials and Equipment

Group I — Metals	
(1) Steel Plates	2,000 tons
(2) All other Carbon Steel	3,000 tons
(3) Cast Iron	3,357.4 tons
(4) Total Carbon Steel and Cast Iron	8,357.4 tons
(5) 18% Cr. 8% Ni.	187.9 tons
(6) 3½% Nickel	21.5 tons
(7) Admiralty 71% Cu. 28% Zn. 1% Sn.	34 tons
(8) Naval Bronze 88% Cu. 10% Sn. 2% Zn.	20.5 tons
(9) Copper	150.7 tons
(10) Brass 65% Cu. 35% Zn.	109.3 tons
(11) Hastelloy D 85% Ni. 3% Cu. 2% Fe. 10% Si.	17.5 tons
(12) Monel 70% Ni. 30% Cu.	3.5 tons
(13) Lead	381.6 tons
(14) Mercury	1 ton
(15) Rubber	2.2 tons
Group II — Building Materials	
Electrical Fittings or Appurtenances	112.5 tons
*Electrical Lighting Fixtures	1,425 units
Plumbing Fixtures	25 units
Portland Cement	15,000 bbl.
Brick — Common Red	292 M
Clay Pipe, Glazed Sewer Pipe	$5,000
Roof, pre-cast gypsum plank	11,160 sq.ft.
Construction Lumber	965 M.bd.ft.
Railroad ties — Treated	750 Pcs.
Insulation Board	82,500 bd.ft.
Corrugated Asbestos Cement Sheets	100,000 sq.ft.
Asbestos Sponge Felt	$54,000
Asbestos Sponge Felt	19,000 section
Heating Coils and Convectors (for buildings)	12 units
Group III — Process Equipment	
Pumps — 152 Units	$102,700
Cooling Towers — 2 Units	80,000
Boilers — 3 Units — 1,000 hp.	100,000
*Instruments	212,500
Finishing Equipment	370,000
Compressors — 12 Units — 1,500 hp.	561,600
Group IV — Drivers and Power Generation	
Turbines — 26 Units — 2120 hp.	$32,000
Motors — 238 Units — 4338 hp.	63,500
Transformers and Switchgear	93,000
Motor Starters — 238 Units	25,700
Group V — Appurtenances	
*Plant Telephone	$3,000
*Construction Tools and Equipment	70,000
*Laboratory and Office Equipment	2,500

* Metals for fabricating items marked with asterisk are not included in Items 1-15.

Appendix D—Conservation Suggestions in Regard to Buildings and Utilities

Critical Materials	Modifications, Suggested Alternatives and Options
Structural Steel	(1) Wood or (2) reinforced concrete except where structural steel is absolutely essential.
Reinforcing steel	Use wood in lieu of reinforced concrete wherever practical.
Steel Mesh	Omit in roadways and slabs on ground. Omit galvanized mesh.
Corrugated sheet iron, galvanized	Cement asbestos
Corrugated sheet iron, asphalt protected	Cement asbestos
Steel sash	Wood preferred, except for fire exposures.
Steel bucks, door, etc., frames	Wood preferred; painted steel clad, if necessary; for fire protection, use wood cored, metal-covered doors with terneplate covers.
Nails	Omit any galvanising, except where absolutely essential.
Sheet piling	Wood creosote, if permanent.
Metal lath	Eliminate, if practical.
Fence	Restrict to enclose built-up areas. No galvanising; use wood posts; no steel top rails.
Sheet Metal[1]	
Roofing, flashing	Built-up roofing, flashing ferrous, non-metallic coated, or tight zinc coated.
Down spouting and gutters	Ferrous, non-metallic coated, or tight zinc coated.
Weather stripping	Use galvanized non-metallic materials.
Screening	Ferrous painted.
Utilities	
Iron sewer pipe	Use terra cotta, standard or medium soil or concrete pipe wherever practical. Where iron is necessary, use minimum weight piping.
Steel sewer pipe	
Iron and steel sewer pipe fittings	
Steel gas lines	No galvanising.
Water pipe lines (underground)	Over 3 in. diameter, use asbestos cement pipe, and/or over 24 in. use concrete pipe. Eliminate all galvanising as far as practical.
Conduit	Use galvanized conduit only for extreme conditions; otherwise non-metallic coated. Eliminate conduit by use of non-metallic sheathed cable wherever practical. Use asbestos-concrete where possible.
Conduit fittings	Omit galvanising wherever possible — use non-metallic coatings. Porcelain boxes where non-metallic sheathed cable is used.
Water storage tank	Use wood or concrete.
Electric lighting fixtures	For interior use, non-metallic type or light gage ferrous sheets, spun, stamped or drawn with non-metallic protective coating and non-metallic shades and reflectors. For exterior use, non-metallic shades or ferrous fixtures with non-metallic coating. Metal posts for supporting fixtures are not permitted. Copper or copper alloy permitted for current carrying parts. Socket shells and covers shall be non-metallic.
Heating	
Coils and convectors	No copper.
Radiators, iron	Iron.
Brass traps	Eliminate all possible brass; ferrous bodies for sizes over 2 in.
Miscellaneous	
Valves	Yellow brass valves permitted for 2 in. size and smaller: ferrous metal with yellow brass, stems, seats, and disks for larger sizes.
Steel rails	Attempt to use second-hand rails.
Office furniture and locker	Office furniture, lockers and shower stalls should be of non-metallic construction.
Stairs, railings, ladders	Use minimum amount of metal; use wood or concrete where possible.
Plumbing and heating fixtures	Use unplated ferrous fixtures.
Finish hardware	
Lavatory fixtures	Use vitreous fixtures.
Paint	No aluminum paint shall be used.
Switch and receptacle plates	Use non-metallic material.

[1] Galvanized iron and steel shall be used only where unusual conditions of corrosion exist. Copper shall be used only for electrical use and where corrosion permits substitution of no other less critical material. Use wood in place of metal wherever possible. Plated and ornamental iron and steel are not permitted.

SUGGESTIONS ON PROCESS EQUIPMENT

1. Observe conservation suggestions outlined in Appendix A where applicable to process equipment.
2. Make all possible substitutions down the list vertically. This list is a general guide and is subject to change.

Magnesium	Lead
Aluminum	Steel
Nickel	Silver
Monel	Glass-Lined
Stainless Steel	Glass
Tin	Reinforced concrete
Chromium Alloy	Tile
Copper	Brick
Copper Alloys	Wood
Zinc	

PD-200
1/2/42
ORIGINAL

WAR PRODUCTION BOARD
DIVISION OF INDUSTRY OPERATIONS

APPLICATION FOR PROJECT RATING

To: DIRECTOR OF PRIORITIES, WAR PRODUCTION BOARD, *Washington, D. C.*

INSTRUCTIONS FOR PREPARATION OF APPLICATION FOR PROJECT RATING

Fill out in quintuplicate and execute the Certification on the original copy. Retain the quintuplicate copy and send all other copies to the Division of Industry Operations (PD–200), War Production Board, Washington, D. C. Where space on the form is not sufficient to furnish the information required or additional relevant information, attach supplemental typewritten statement in quadruplicate. Applicant must be owner or lessee of site of proposed project.

DO NOT FILL IN

SERIAL NO. .....
PRIMARY INDUSTRIAL BRANCH .....

Instruction No.	To Be Answered Below by Applicant
1	Name of applicant.
2	Address of applicant.
3	Location of project.
4	Have you applied for a Government Certificate of Necessity? If so, identify complete reference.
5	Describe project in sufficient detail for complete identification, including— (*a*) Number of buildings. (*b*) Type of construction of each building.
6	Describe product or service to be produced by the project for which application is made.
7	State capacity of proposed project in terms of product or service to be produced.
8	Explain in detail relationship of such product or service to national defense, public health or safety, or Government-sponsored programs.
9	Is proposed project— (*a*) A new facility? (*b*) Addition to existing facility? (*c*) Remodeling of existing facility?
10	Is proposed project under construction? If so, state— (*a*) Date started. (*b*) Percent of completion.

Instruction No.	To Be Answered Below by Applicant
11	State estimated completion date of project.
12	State estimated cost of project, exclusive of site.
13	How is project being financed?
14	If project will increase manufacturing facilities, state— (*a*) What percent of your total current business consists of orders rated A–10 or better? (*b*) What percent of your current business, limited to the product(*s*) to be produced by the project, consists of orders rated A-10 or better? (*c*) Pattern of rated orders referred to in paragraph 14 (b), for example: 7 percent—A–1–a; 10 percent—A–2; 30 percent—A–5; etc.
15	Explain in detail what consideration has been given to— (*a*) Temporarily using other available facilities (as vacant building). (*b*) Reconditioning existing facilities. (*c*) Increasing productiveness of present facilities (as by working additional shifts or otherwise gaining objectives of proposed project).
16	Identify and attach evidence (if any) of Federal, State, or local government endorsement of this application.
17	Have you made other or previous application related to proposed project or any part thereof? If so, explain.

Instruction No.	Identify Each Statement With Corresponding Instruction Number (shown above)

Form PD-200, designed by W.P.B. to cover all construction, should be supplemented according to suggestions given in this article

3. Steel Plate. Design vessels so that plates from universal and strip mills may be used. Use shear mill plates where necessary to meet ASTM specifications. Avoid the use of steel plate such as can be rolled on only one or two mills. This does not mean, however, that all steel plate should be kept in narrow widths, for if this were done in all cases, mills would be rolling widths too narrow for maximum production.
4. Avoid the use of nickel, Monel, stainless, aluminum, copper, etc., by using glass, tile and other nonmetallic linings. Wherein it is absolutely necessary to use these metals, use clad construction.
5. Keep gages of tubes and lining thickness to a minimum.
6. Use galvanized steel nails, bolts, etc., in the construction of cooling towers rather than copper and copper alloys.
7. Use natural rather than forced draft cooling towers where space and operating conditions permit.
8. Consideration should be given to the use of spraying, parkerizing and bonderizing for corrosion resistance.
9. Consider the possibility of bimetallic tubes.
10. Where copper and copper alloys are essential, reduce the copper content as much as possible.
11. Consider the use of plastic type linings in place of rubber and critical materials.
12. Consider the use of glass, porcelain, and carbon in process piping where low pressures are involved. Where alloy steel is essential, reduce the vanadium, nickel, molybdenum and chromium content as much as possible. These alloying elements have been listed in the approximate order of the most critical element first, and substitutions should be made in that order.
13. Following are a list of conservation measures in regard to alloy steels which have been effective in certain chemical plants:
    A. The use of cast iron or enamel iron in place of 17 percent chrome for bubble caps.
    B. 25-20 chrome nickel for furnace hangers and tubes are being abandoned for 25-12. Further reductions might be made where less severe service is encountered. In one case 18-8 is being used for these parts.
    C. 2½ percent chrome, 1 percent moly steel has relatively good strength at 1400 deg. F. At least one company is using this grade in place of 25-12 for those parts not exposed to severe oxidation.
    D. Enameled impellers are being substituted for stainless in pumps in certain instances.
    E. Redesign of furnaces has resulted in substantial reductions of alloy steel at the same time maintaining same grade.
    F. Insuline (pipe) has been developed for use in high-temperature, low-pressure service. It is understood that this pipe is made up of a thin shell of alloy steel with an outside thin shell of carbon steel with a noncritical insulating material be-

tween. This is being substituted for solid alloy pipe.

G. In temperatures as low as 150 deg. 18-8 has been specified in certain instances where as it is understood that 3½ percent nickel steel is satisfactory; whereas it may be even possible to reduce the alloy still further by using ¾ percent chrome, ¾ percent nickel, and 1 percent copper, which it is understood, gives a satisfactory impact test at minus 150 deg. F. and can be welded satisfactorily.

H. In one instance of low-pressure, high-temperature work, carbon steel tubing was wrapped with alloy sheet and welded where it was merely necessary to protect against external oxidation.

I. Consideration has also been given to the use of cast refractories together with alteration of furnace designs to eliminate the use of tube supports.

J. In certain instances 17-4-6 chrome-nickel-manganese steel has been used as a substitute for 18-8. It is understood that material of this composition has been rolled in about three mills.

K. The so-called NE (National Emergency) grades of alloy steels have been used as a substitute for SAE alloy open hearth steel by the addition of other alloying elements providing similar properties but requiring less total alloys. Details in regard to these so-called construction steels are available at the American Iron and Steel Institute.

CONSTRUCTION SUGGESTIONS

Assuming that every effort has been made to reduce the plant requirements to a minimum insofar as critical materials and equipment are concerned, that every effort has been made to use second-hand and reconditioned material and equipment, and to shop around to use existing stock, and those frozen by W.P.B., the following are a few suggestions offered to *Chem. & Met.* readers by the Project Rating Unit of the Chemicals Branch of W.P.B. in order to help in getting material delivered to the job:

Steel Plate—Ascertain that the primary purchaser of the steel plate you buy files with the producer Form PD-298, thirty-five days before the month in which the allocation is required. Ascertain that the primary purchaser is advised of the end use by indicating the P-19 number, the rating and the product to be produced. Ascertain that the steel plate is properly classified on PD-298. Group 5A covers aluminum and magnesium, 5B covers chemical projects for items handled by W.P.B. with the exception of synthetic rubber and toluol. 5D covers iron and steel expansion. 5E covers mining. 5F covers petroleum products except synthetic rubber and toluol. 5H covers synthetic rubber and 5I covers toluol.

Only by proper classifications do these requirements come to the attention of the end group concerned. In addition, all urgent tonnage should be called to the attention of the end-product group by special communication. Steel plate should not be requested unless it is required for the month for which the PD-298 is submitted.

Nickel and Alloy Steel—Ascertain that the end use is clearly indicated in all purchases so that it may be passed on by the companies requesting the metal from W.P.B.

PLANT-DESIGN SUGGESTIONS

We are indebted to the Petroleum Coordinator and specifically to Max B. Miller, for the privilege of abstracting some of their suggestions that may find application in other of the chemical process industries.

Steel Tubes—One manufacturer of alloy tubes advised the Coordinator that he had received orders from various petroleum refiners specifying 19 different sets of specifications. Naturally this seriously interfered with the productivity of the tube mill. It was therefore suggested that alloy tubes henceforth be confined to the following general classifications: (1) Low carbon steel. (2) Low carbon steel with ½ percent molybdenum. (3) 2-3 percent chrome steel with ½ percent molybdenum. (4) 4-6 percent chrome steel with ½ percent molybdenum. (5) 7-9 percent chrome steel with ½ percent molybdenum. (6) 18 percent chrome, 8 percent nickel stainless steel. Since seamless steel tubing is essential to the manufacture of bombs, petroleum refiners are urged to use electric welded tubing or butt-welded pipe wherever possible.

Compressors — Because compressors of less than 300 hp. are more readily available than larger units, it is suggested that batteries of these might be substituted for larger single units under certain circumstances. In some instances absorption refrigerating units have been used as an effective means of reducing the compressor load.

Valves and Fittings — Cast-iron valves should be substituted for steel valves wherever possible, particularly in the smaller sizes. The elimination of alloys in valve bodies will help the situation materially. The practice of prefabricating and/or the welding of pipe should be carried to the limit.

Pumps—Some pump manufacturers have received orders for more pumps than they can deliver according to schedule. At the same time other companies could take on greater commitments if the orders were placed with them.

Small Items — The Coordinator's office recently received a number of complaints because of the inability of a single manufacturer to deliver a particular type of gasket. There were many other manufacturers who could supply suitable gaskets immediately. Because such minor items can and do hold up the completion of various major projects, the Coordinator urged that the work of manufacturing be spread through as many plants as possible so that the full productive capacity of the country may be utilized.

Water-Supply Lines—One refiner recently applied for priority in fittings to complete a 54-in. cast-iron water-supply line for which the pipe had already been delivered. He was told that hereafter reinforced concrete pipe should be used wherever possible. This suggests wider use of masonry for steel in other applications. For example, brick or concrete stacks are satisfactory where suitable foundations can be laid.

Plant Design—Another severe bottleneck in completing the petroleum industry program is in connection with the designing and erecting of plants by engineering and construction companies. Rather than having each installation "tailor-made" to its individual pattern of charging stock, yield and product requirement, the O.P.C. points out that plants previously designed for other installations should be utilized wherever possible, even if it means the sacrifice of some minor, particular, isolated requirement of the individual refiner.

In general, the builder should work in close cooperation with the construction branch of the W.P.B. and the end-product branch in order that the construction may be harmonized to the greatest possible extent with the general war effort. It is highly important that both these groups be kept in constant touch with construction progress, preferably, providing them with construction schedules.

Reprints of this 8-page report are available at 25 cents per copy. Address the Editorial Department, *Chem. & Met.*, 330 W. 42nd St., New York, N. Y.

Machinery, Materials and Products

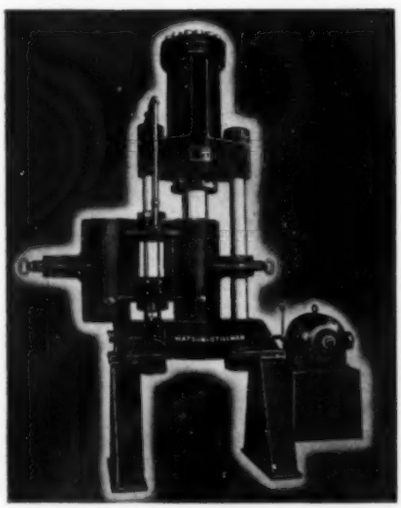
Belt Conveyor Idlers

ENGINEERS OF the Industrial Division, Continental Gin Co., Birmingham, Ala., have recently developed a streamlined belt conveyor idler with several improved features. Idler rolls of all types are easily removed from supporting brackets by simply lifting them out. This can be done with the conveyor in operation. All rolls are made in 4, 5 and 6 in. diameters of either cast iron or steel and are equipped with anti-friction bearings. Grease seals are all-metal labyrinth type, having 5 passes with the inner members protected from damage by a malleable iron nut. These seals prevent both dirt and water from getting into the bearings. Supporting brackets are made of high-grade malleable iron and are amply ribbed for strength. Brackets are jig welded to inverted angle base or to channel bases. This construction gives a one-piece unit in a simple rigid design.

Hydraulic Straining Press

A 200-TON hydraulic straining press, manufactured by the Watson-Stillman Co., Roselle, N. J., and illustrated on this page, strains or filters fluids under a pressure of 2,000 lb. per sq.in. The machine has two cylindrical containers, each 10 in. in diameter and 33 in. deep, mounted on a swinging arm so that one may be filled while the press strains material from the other. The press is completely self-contained, including 20 hp. motor, 18 gal. per min. pump, and oil tank. The entire unit stands 14 ft. high, weighs 15,000 lb. and requires 5 ft. by 3 ft. of floor space. Control is by a single, lever-operated valve. The main ram has a 33-in. stroke that operates in a double-acting cylinder. Two container lifting cylinders facilitate swinging of the containers between loading and straining operations.

200-ton hydraulic straining press



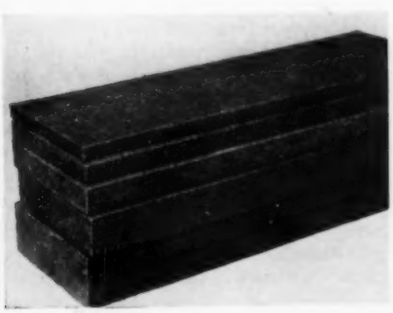
Oil-Immersed Starters

A LINE OF oil-immersed starters incorporating design features which facilitate installation, service and operation, has been announced by the Industrial Controller Division of the Square D Co., 4041 N. Richards St., Milwaukee, Wis. Easier installation is provided through use of a cast head with a wiring manifold which permits conduit entrance from five directions. A removable cover plate facilitates threading of the bare wire through an insulating spacer above the oil bath. The welded seam tank is designed for a minimum quantity of oil and a large oil-level gage provides quick, clear visibility. Track-type guides prevent splashing or accidental collision with the starter panel while the tank is being raised or lowered. Either hand or automatic reset relays are available. Two kinds of oil-immersed inclosure construction are available; the first corrosion-resisting and the second explosion-resisting for Class 1, Group D hazardous locations. Both can be furnished with either Class 8537 line voltage starters, combination starters, or reversing starters, or with Class 8810, two-speed starters.

Mineral Wool Board

A MINERAL WOOL board type of insulation for cold storage has been introduced by the Building Materials Division of the Armstrong Cork Co., Lancaster, Pa., as an addition to the company's line of low-temperature insulation products. The new insulation is a non-priority material and is available for all kinds of installations. The material, illustrated on this page, has been proved in more than 200 installations within the past six months. It equals or exceeds Federal Specification HHM-371 for board or block form insulation, having a thermal conductivity ranging from 0.31-0.33 at 90 deg. F.

Mineral wool board insulation



CHEM & MET PROCESS EQUIPMENT NEWS

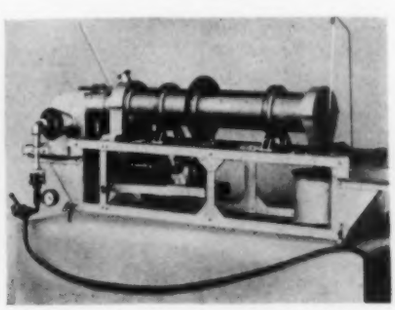
The new material has good moisture resistance, is self-supporting and will stay permanently placed without sagging, settling, shrinking, swelling or warping. It is also free from any liability to rot, mold or harbor vermin. Manufactured in board size of 12 in. x 36 in., and thicknesses of 1 in., 1½ in., 2 in., 3 in. and 4 in., the mineral wool board is applied essentially the same as corkboard. Erection in hot asphalt with multiple layer construction is recommended.

Experimental Rotary Dryer

THE C. O. BARTLETT & SNOW CO., Cleveland, Ohio, has recently introduced a small-size rotary dryer suited for experimental and research work in laboratories and for student instruction in technical schools and colleges. The unit, illustrated on this page, has a cylinder 6 in. in diameter by 36 in. long, fitted with internal feed and lifting flights. The cylinder is carried on a pair of steel riding rings, supported on trunnion rolls and is rotated with a girt gear and sprocket drive. Rotating speeds vary from 2.06-4.92 r.p.m.

Heat for drying is supplied by burning any of the standard bottle gases. Air temperatures range from 110-800 deg. F. and air volumes may be regulated up to about 100 cu.ft. per min. The heating unit is easily transferred from one end of the dryer cylinder to the other, permitting the dryer to be

Laboratory rotary dryer



used in either parallel or counterflow operation. The whole apparatus can be set for any slope to the horizontal by turning jack screws.

Cork Substitute

PRODUCTION BY Owens-Corning Fiberglas Corp., of its new asphalt enclosed Fiberglas board for low-temperature and roof insulation releases this country from dependence upon cork for such insulation. The new product is expected to replace cork in food refrigeration and also in industries where cold processing of materials such as oils, chemicals, rayon, etc., requires close control of temperature.

Fiberglas AE board is made in the American standard size for refrigeration insulation (12 in. by 36 in.) and in thicknesses of 1, 1½ and 2 in. It is made of glass fibers, compressed to a density of 6 lb. to the cu.ft. and completely enclosed in a sheath of durable asphalt with a high melting point. Its heat conductivity is 0.265 B.t.u. per sq.ft. per hr., per deg. F., per inch thickness at a mean temperature of 60 deg. F. When exposed in a humidity cabinet of 70 deg. F. and 65 percent relative humidity, the moisture pick-up from a previously dry condition is 0.064 percent by weight. The insulation has high resiliency, and shows almost complete recovery in 5 minutes after loading to 1,728 lb. per sq.ft. The board will withstand walking on in floor and roof applications.

Drum and Barrel Carrier

THE NEW Ernst Drum and Barrel Carrier has just been announced by the Ernst Magic Carrier Sales Co., 1456 Jefferson Ave., Buffalo, N. Y. This new model, shown in an accompanying illustration, is designed to handle light wood, fiber, paper barrels, and "one trip" light gage steel containers with or without chimes. The capacity of the unit is 800 lb. and it will accommodate drums and barrels from 14 in. to 24 in. diameter. Three-wheel construction automatically balances the load for safer and easier moving of containers and operation is so simple that one man can take care of it. Another feature is the straight, vertical lift of the barrel from the floor to prevent any flowing over of contents from open-head containers.

Drum and barrel carrier

Time Schedule Controller

THE NEW Taylor Fulscope time schedule controller, developed by the Taylor Instrument Cos., Rochester, N. Y. maintains temperature, pressure, flow or liquid level according to a predetermined time schedule. It is possible to automatically and precisely repeat the process as many times as desirable.

Both cam and chart are individually mounted and conveniently located for instant visual comparison. Among the improved features of the new unit are: friction drive cam assembly which permits rotation of the cam without loosening any locking means; improved means of resetting one cam without disturbing the other in an instrument with two complete control mechanisms; each cam capable of operating 1-4 air valves, micro-switches or both for the actuation of any external mechanisms and to do this automatically in any desired relation of one to the other; automatic return of the cam to the starting position. An optional feature is the Interrupter Climber which allows flexibility to both the rise and the holding periods of the process under control. This allows use of a very fast cam clock for a rapid rising period, but reduces the speed of the clock to increase the length of the holding period. The rising period, the holding period, or both, may be increased as much as 6½ times normal.

Welding Technique

A NEW TECHNIQUE in fillet welding by electric arc process, called the "Fleet-Fillet" technique, has been announced by the Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio, after extensive study and research by the concern's engineers and research technicians. The new technique, which permits up to 100 percent faster fillet welding, made possible in one typical case an arc speed of 65 ft. per hr. for welding a ⅜ in. horizontal fillet as compared with 30 ft. per hr. using conventional procedure. The new technique makes possible faster weld production without increasing operator fatigue, reduces amount of welding electrodes per foot of weld, and lowers welding costs.

Overhead Traveling Crane

EFFECTIVE IMMEDIATELY, the Harnischfeger Corp., Milwaukee, Wis., announces that Trav-Lift cranes will include two added features of standard equipment. All double I-beam cranes employing a motor-driven trolley will be equipped with a drag brake on the trolley. All cage-controlled "Trav-Lifts" will be furnished with a foot gong. Formerly these accessories were available on special order only. P & H Trav-Lift cranes are made in capacities up to 15 tons and are suited for intermittent service and for supplementary usage with the large overhead traveling cranes also manufactured by the concern.

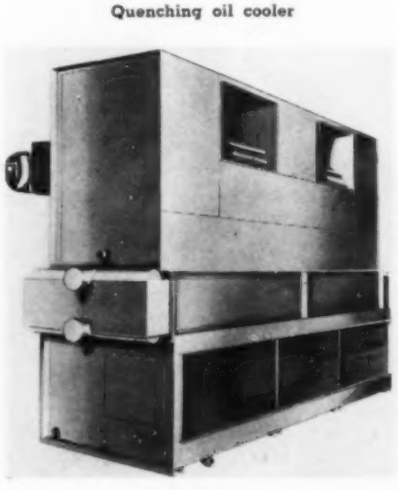
Solvent Extraction System

IT HAS BEEN recently announced that the Wolf Co., Chambersburg, Pa., has taken over the manufacture of equipment for the Kennedy continuous solvent extraction system. This method of continuous solvent extraction offers an improved process for the production of oil, fats, and greases of various types. It is also adaptable to many leaching and extraction problems other than solvent extraction and has shown a marked saving in the extraction of water-soluble constituents such as natural dyes and tanning extracts. At the present time, experimental tests are under way on the application of the Wolf "Kennedy" extraction system on tung nuts for the production of tung oil.

Quenching Oil Cooler

A NEW QUENCHING oil cooler applicable for a variety of process liquids as well as for metallurgical processing, has been announced by the Trane Co., La-Crosse, Wis. The unit, illustrated on this page, utilizes the atmospheric evaporative principle and is ordinarily applicable where the use of water is uneconomical or impractical, where water temperature is too high, or where it is not necessary to maintain quenching bath temperature below 100 deg. F. The unit is self-contained and can be placed inside the area in which the quenching oil cooling operation is conducted. It can be suspended from the truss structure of the building, thus conserving floor space. Other mechan-

Quenching oil cooler



ical features include a rigid angle iron framework with heavy gage side sheets, a light-weight, high-heat transfer type of oil cooling coil; ample size squirrel cage fans, mounted on a heavy ground and polished steel shaft; and a heavy gage steel spray water tank and angle supports. A pump circulates oil from the quenching tank through the cooler and back to the quenching tank. Any desired temperature not lower than 100 deg. can be maintained automatically.

Disconnecting Switch

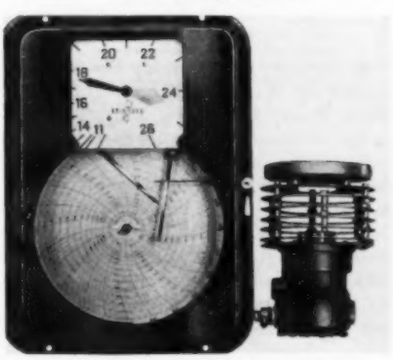
A NEW HIGH-PRESSURE contact heavy-duty disconnecting switch has been announced by Delta-Star Electric Co., Chicago, Ill. This new 3,000-amp., 23 kv. hook stick-operated switch has high-pressure silver to copper contacts at both blade ends. The design embodies a straight line current path with current carrying parts of hard drawn copper, thus eliminating castings. Rugged locks and a pressure releasing device are standard equipment. Clamp type lugs for IPS tubing can be furnished or switch pads for square tubing or flat bars. These Type B2-P switches in capacities from 2,000-6,000 amp. and up to 24.5 kv. ratings are available.

Radiation Pyrometer

A NEW RADIATION pyrometer, known as the Pyrovac, has been developed by the engineers of the Bristol Co., Waterbury, Conn. This new instrument, illustrated by an accompanying cut, is designed for recording, indicating, or automatically controlling temperatures in furnaces and kilns above 900 deg. F. The temperature-sensitive unit or radiation head is mounted on the outside of the furnace out of the hot zone where it picks up heat rays emitted from the object under measurement, thus registering its surface temperature.

The Pyrovac pyrometer is intended for use in measuring and automatically controlling temperatures that fall into the following classifications: (1) high temperatures out of the range of the thermocouple; (2) temperatures for which rare-metal thermocouples are used; (3) surface temperatures and the temperature of the work itself rather than furnace or kiln temperatures surrounding the work; (4) where the object is moving, is inaccessible, or where there are space limitations.

Radiation pyrometer



Concrete Pier Form

A NEW FAST and cheap method of forming concrete piers has recently been announced by Sonoco Products Co., Hartsville, S. C. The Sonoco laminated spiral wound tube for concrete pier forms has been thoroughly tested and approved by engineers.

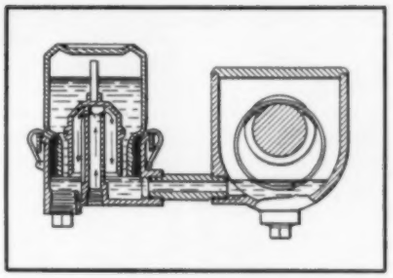
The form consists of made-to-size, spiral-wound laminated paper tubes with the inside oil treated. The units are available in lengths up to 24 ft. and inside diameters of 9 in., 11¼ in., and 13½ in. The tubes are simply cut to length on the job by hand or power saw in a matter of seconds and the form is tacked into upright position. Concrete is then poured into the form. Forms are easily stripped off after piers set up, although this is not necessary as they will eventually slough off if exposed to moisture. An inexpensive stripping tool has been devised for this operation. It is claimed that the forms result in extensive labor and material savings.

Intercommunication System

DESIGNED ESPECIALLY to facilitate moving of stations and expansion of the automatic interior telephone system in office and plant layouts, this new telephone announced by Select-O-Phone Co., 1012 Eldy St., Providence, R. I., may be plugged into any terminal box, which requires only a single strand of triple-conductor wire to be run to the Select-O-Phone switchboard. The center of the dial is a code-ringing button which is pressed to code signal where several persons may be served by one telephone, or when using the built-in general call paging circuit. All plug-in telephones are interchangeable. Dialing any number automatically connects to the desired party in a secret conversation. Provision is also included for secret conference among three or more persons. The capacity of the system is from 5-55 lines, with extension possibilities to 100 or more stations.

Constant Level Lubricator

IN ORDER to prevent oil waste and to insure lubrication, the Oil Rite Corp., 3466 S. 13th St., Milwaukee, Wis., has developed a new unit known as the Oil-Rite Constant Level Lubricator. The unit holds a visible reserve supply of oil and releases automatically just as much as is needed to maintain a constant predetermined level of lubrication. The unit, illustrated on this page, is said to insure adequate lubrication at all times and prevent oil waste and the deterioration of material caused by oil throw.



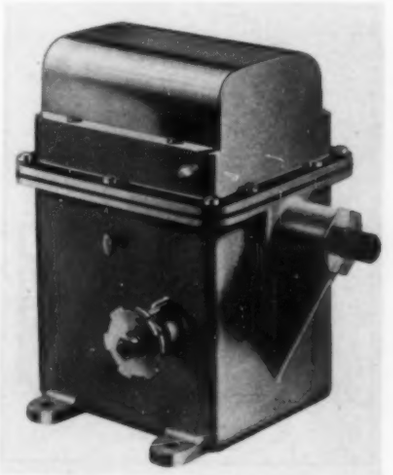
Constant level lubricator

Construction of the lubricator consists of three simple parts. The base is cast of Zamak metal with an integral open air vent extended part way up into the oil reservoir. Over this vent is fitted loosely an inverted bucket or bell. The reservoir proper is a glass dome, sealed to a metal collar by plastic porcelain cement impervious to acids, oils, water and heat. Two spring clips lock the oil reservoir in position. When the reservoir is filled and inverted into position on the base, the lower edge of the inverted bucket determines the oil level that will be maintained. When the level falls below this point, air from the vent escapes under the side of the bell up to the top of the lubricator, permitting oil to flow down until the level again seals across the base of the bell. Oil-Rite constant level lubricators are available in four standard sizes, with capacities of 2, 4, 8 and 16 oz.

Valve Controller

FOR OPERATION of butterfly valves, multiple ratio fuel valves, and regulation of dampers in air conditioning and drying systems, the Barber-Colman Co., Rockford, Ill., has recently announced a new control unit known as the Microtrol. The unit features a high torque proportioning control motor with built-in limit switches and potential

Valve control unit



dividing rheostat. Output shaft is driven by the company's shaded pole induction motor through gear reduction of machine cut, heat-treated gears. Oil-submerged units have the operating mechanism completely submerged in oil and sealed in die-cast cases. The new unit is illustrated by an accompanying cut.

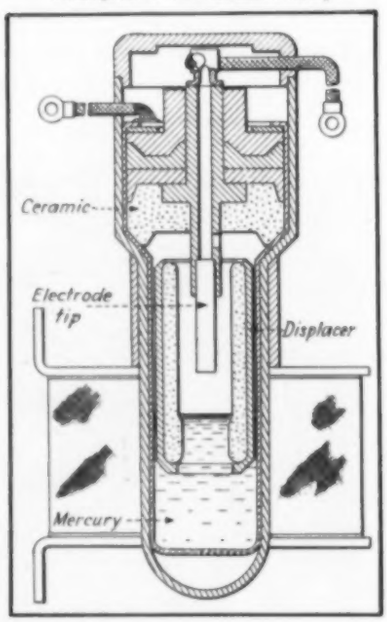
Remote Speed Indicator

A NEW TYPE electric remote speed indicator for use with the concern's variable speed control equipment has been announced by Reeves Pulley Co., Columbus, Ind. This instrument gives a reading in terms of "speed setting" of the output shaft of the Reeves drive. The indicating meter is really a voltmeter with a long, 4-in. arc scale built integrally with a pair of electric control push buttons in a cast iron housing. The indicating system is made in two parts; one consisting of the push button and indicating meter, and the other a potentiometer mechanism mounted on the drive near the shifting screw. The mechanism is actuated by rotation of the shifting nut or movement of the sliding base, and such movement is transmitted to the potentiometer which varies the voltage impressed upon the indicator. Power supply for the indicator is self-contained in the form of a single standard size flashlight cell.

Blackout Relay

A NEW BF blackout relay which works under a hydrogen quenching atmosphere has been announced by Durakool, Inc., 1010 N. Main St., Elkhart, Ind. Principles of the relay are shown in an accompanying illustration. It is claimed that no arcing, pitting or burning of the electrical contact members can occur and no moving part other than the liquid and its float are involved. Built especially for war-time purposes, the unit is designed to take unusual knocks and hardships without failure. The iron displacer is lined with ceramic and normally floats on mercury. When current is passing through the solenoid, the displacer is pulled down, thus raising the mercury level and bridging the electrode to the metal shell. The tube is filled with an inert gas under high pressure. The unit is non-explosive, quenched arcing and highly shock-resistant.

Principles of the blackout relay



Equipment Briefs

A NEW LINE of temperature measurement colors, known as the Thermindex Colours, has been announced by J. M. Steel & Co., Ltd., Kern House, 36-38, Kingsway, London. The method is of particular interest to the metal industries, as it gives temperature distribution over a heated surface instead of the temperature at any specific point, such as usually would be obtained with the more usual measuring devices. The colors are offered in the form of a paint suitable for direct application to practically any surface by brushing or spraying. When the temperature of the treated surface is raised, the original color of the pigment changes sharply at a definite point and the new color persists after the surface has cooled down. Colors covering a wide range of temperatures are available.

A QUICK-HARDENING iron cement for patching concrete floors has been announced by Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City, N. J. The new product hardens quickly and adheres firmly to the surfaces with which it is in contact. It has an iron base and is wear-resistant as well as dustproof, oilproof and waterproof. Patches of the material harden overnight and become stronger with age.

THE LINCOLN ENGINEERING Co., 5701 Natural Bridge Ave., St. Louis, Mo., is now manufacturing forced-induction pumps known as the "Pile Drivers". These pumps are designed to dispense heavy viscous materials such as sealing compounds, sound deadeners, insulating materials, putty, heavy lubricants and other substances too heavy and solid to prime in any other type of pump. The units do away with the old stuffing-by-hand and putty-knife and paddle methods. The pump is available in single or 2-stage models and two sizes can be furnished. The single-stage unit is for use where pulsation in the flow of material is permissible, while the 2-stage unit has a pulsation eliminator. Delivery of material is controlled by a hand-operated shut-off valve at the outlet.

A NEW technique for the colorimetric determination of pH has been developed by R. P. Cargille, 118 Liberty St., New York, N. Y. Solutions of known pH made by dissolving a tablet are applied to the test paper to bring out on the paper the color for any half-units from a pH of 3-11. The colors are used for reference to judge the pH of the sample and it is claimed that comparisons made with these reference colors are more accurate than those made with color charts. The unit is designed for control tests in the plant by unskilled workmen and for quick, preliminary tests in laboratories.

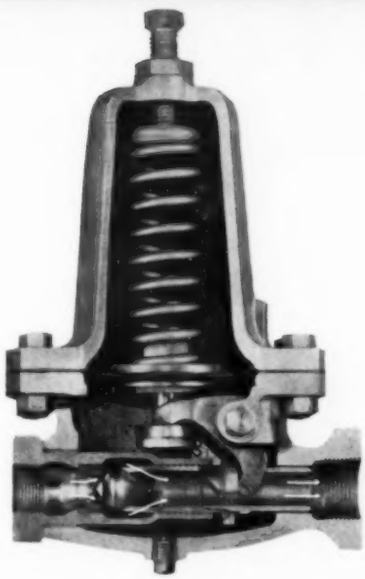
A NEW SPARKPROOF, static-proof truck and caster type phenolic molded canvas wheel, called the "Formica Staticon," has been developed by Divine Bros. Co., Utica, N. Y. The wheel is designed for proper dissipation of static electricity that builds up in factory trucks and is recommended for use in ordnance plants, shell loading factories, and other places where sparks are a hazard. A laminated canvas tire is impregnated with a colloidal graphite compound which makes an electrical conductor within the fabric itself. The hub material is similarly impregnated with a graphitic compound, the two elements being permanently connected by copper cable molded within the wheel body, thus forming a continuous contact from the truck, through the wheel housing, shaft and wheel to the floor surface. The synthetic varnish introduced into the wheel during the molding process protects the conductive element from moisture absorption. The wheel is fully floor protective, chemically inactive, non-corrosive and quiet in operation. Sizes range from 3-12 in. wheel diameters.

THE NEW "Safront" resistance welder control introduced by the Square D Co., 4041 N. Richards St., Milwaukee, Wis., places all electrically energized parts behind a protective panel, thus eliminating any danger of shock while timing adjustments are being made. The design provides a separate pneumatic timing device for each step of the welding cycle. Timing periods from 3-100 cycles are accurately obtained simply by turning a wheel. A separable connector permits panel removal without disturbing external connections. Both timers and relays can be serviced with standard tools. Eighteen NEMA standard types of "Safront" weld and timers, plus a wide range of accessories, fill practically any welder requirement.

A MIDGET daylight lamp has been designed by W. A. Taylor and Co., 7300 York Road, Baltimore, Md. The unit is useful in making colorimetric determinations, and although it was originally designed for making determinations at night or in dark places, it has been found to be ideal for all routine testing. The Comparator base sits on the shelf at an angle of 45 deg. so that in making readings the operator looks directly in the slot.

Your CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVES

ARE IMPORTANT PARTS OF YOUR PRODUCTION SET-UP *Now* AND ANYTIME



HERE'S THE "1000" FLOW PATTERN
The Streamlined form of the inner valve eliminates turbulence. It produces the flow pattern shown above which makes for maximum capacity when it is needed most and permits accurate pressure control under toughest working conditions.

You can find out full details on all of the Type 1000 benefits by reading Bulletin "1000" —send for it!

Have you forgotten yours too?

Probably you have forgotten that you had CASH STANDARD Streamlined Valves on your lines though it is a number of years since you purchased them. We can assume this because we have often received letters that read in part like this: "The '1000' valves are honeys. The fact that we don't ever have any trouble with the ones we have installed tends to make us forget them."

Good position to be in

When equipment performs so well that it is forgotten, the user is in a good position. Particularly is this true today when speedier production is demanded and the elimination of lost production hours due to "time out" for troubles is essential. So, if you have "1000" valves in your service now, here is one source that is making a valuable contribution to your speed and cost saving efforts.

Inexpensive Renewal Parts

Experience in thousands of installations show that even after long use, only the valve seat and the seat ring show wear. You can make these simple replacements in your own plant — no delays in returning the valve to us. Rehabilitation of the entire valve is thus easily, quickly, and economically accomplished.

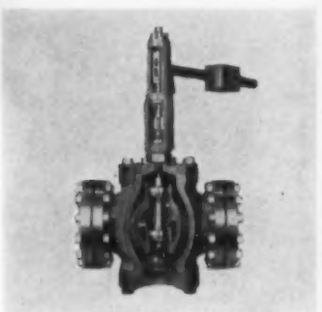
A. W. CASH COMPANY

CASH STANDARD CONTROLS . . VALVES

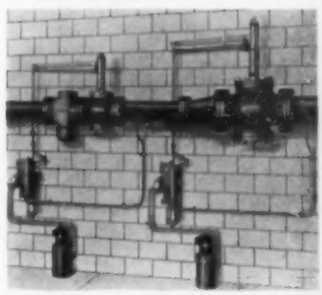
A CASH STANDARD "GET ACQUAINTED" COLUMN

Question: **"Don't you people make anything besides that Streamlined Valve you talk about so much?"**

Answer: **"Yes Sir; we do! And we propose to picture one or two of them here each time."**



For precision jobs — the CASH STANDARD "42-R" Balanced Lever Valve. No lost motion; practically no maintenance. Heavy renewable seat rings; valve stem integral with inner valve. Roller guides kill side strains and stop packing trouble. Comes with parabolic inner valve; flat bevel seat; V-port seat; and V-port non-seating types. Made in sizes ½" to 12" inclusive. For use with pressures up to 600 lbs. Highest temperature 800 deg. F. In iron, bronze, and steel bodies; all standard trims. This valve is made also with center guide, and with Water Cooled, or Air Cooled Packing Box.



Where valve failure would be costly, here are two "42-R" valves operated by CASH STANDARD Type 100 Automatic Controllers, in two-stage pressure reduction. First stage: a 5" Valve reducing 150 to 50 lbs. gauge; second stage: an 8" Valve reducing 50 to 5 lbs. gauge. Load 70,000 lbs. steam per hour. Nearly four years' daily use; not a moment's trouble. (Single stage would have been entirely satisfactory, but customer insisted on double stage reduction.)

Get Free Bulletins on Above . . . Write to A. W. CASH COMPANY DECATUR, ILL.

Brewing of Lager Beer

THE CENTENNIAL of lager beer brewing in the United States is being celebrated this year by the F. & M. Schaefer Brewing Co. of Brooklyn, N. Y.

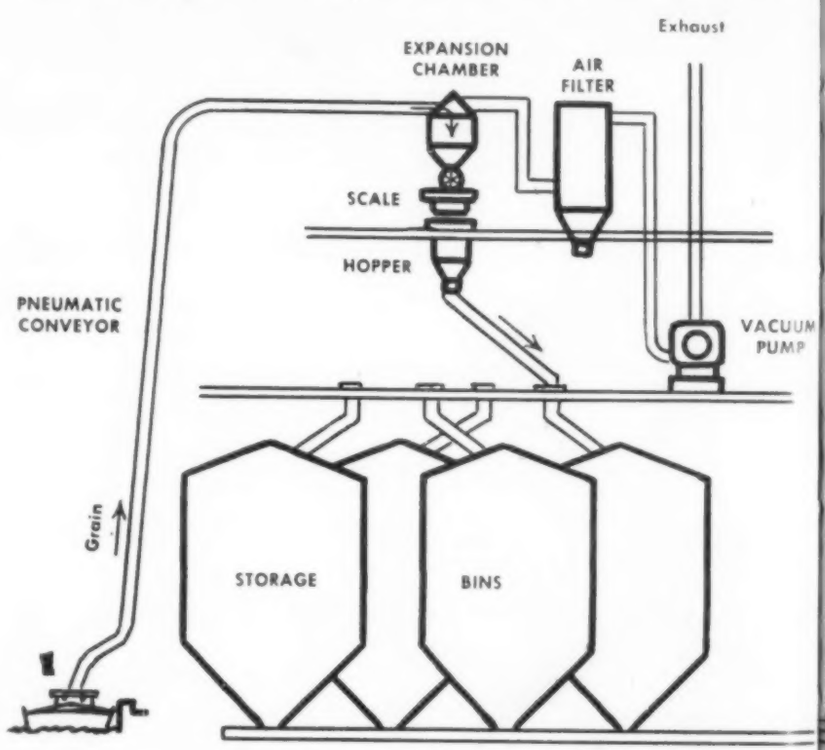
Malt and other brewing materials are received at this brewery by barges and carried to steel storage bins by a pneumatic conveyor. The barley malt is raised to the malt mills by a bucket elevator. A screw conveyor takes the crushed malt from the mills to scale hoppers which insure proper weights for each brew. The grain drops from the scale hoppers to a Monel metal fore masher where it is mixed with hot water to form what is called mash. This mash falls through a large pipe into a stainless steel mash tun where it is mixed by an agitator at controlled temperatures.

During this process the starch is dissolved and converted to maltose and the resulting solution is called wort. The husks and undissolved grain are separated from the wort in a plate and frame filter. The spent grain is used for cattle feed, and the wort goes to large copper brew kettles where it is boiled, concentrated, and flavored with hops. The kettle is emptied through a hop strainer which separates the spent hops from the wort. This hot wort is pumped to a collecting tank in a penthouse before passing through a shell and tube cooler. Active culture yeast is added to the cooled wort as it passes to large stainless steel starting tanks where it is left just long enough for the yeast to start the fermenting process. The wort and yeast from the starters, now called beer, is filled into fermenters where the malt extract is converted into carbon dioxide and alcohol. After approximately seven days, fermentation stops, beer is cooled and put in storage tanks. Yeast which has settled to the bottom of the fermenters is partly reused. The excess is shipped for processing into vitamin products.

Finished fermented beer and a small percentage of young unfermented beer (called Krausen) are mixed in these storage tanks in very cold cellars. The slow fermentation of the Krausen under pressure in these tanks "carbonates" the beer in a natural manner.

When the beer in storage is thus fully carbonated, clarified, and mellowed, it is run through filters for its final polish on its way to the racking room for keg beer and to the bottling house.

1 Pneumatic conveyors of a capacity greater than 1,000 bu. per hr. lift grain 60 ft. to the expansion chamber through which it passes to storage



2 Ground malt and brewing water from fore masher, and grits from cookers (background) go to these mash tuns. Cookers and tuns are stainless steel

CHEMICAL & METALLURGICAL ENGINEERING

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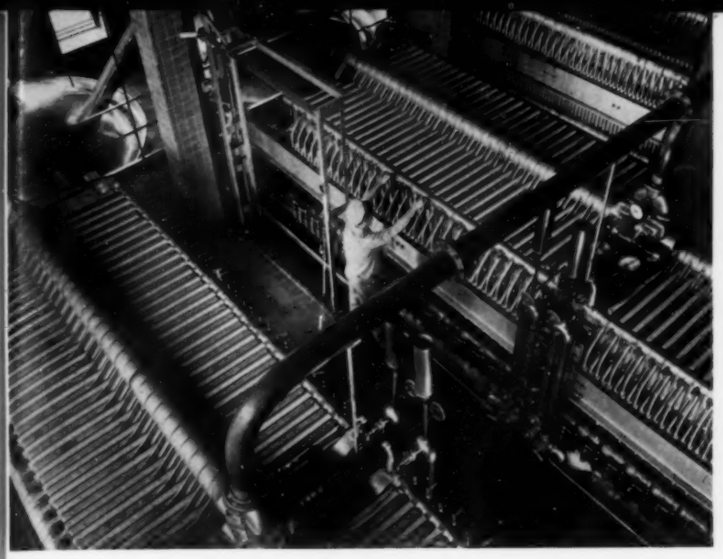
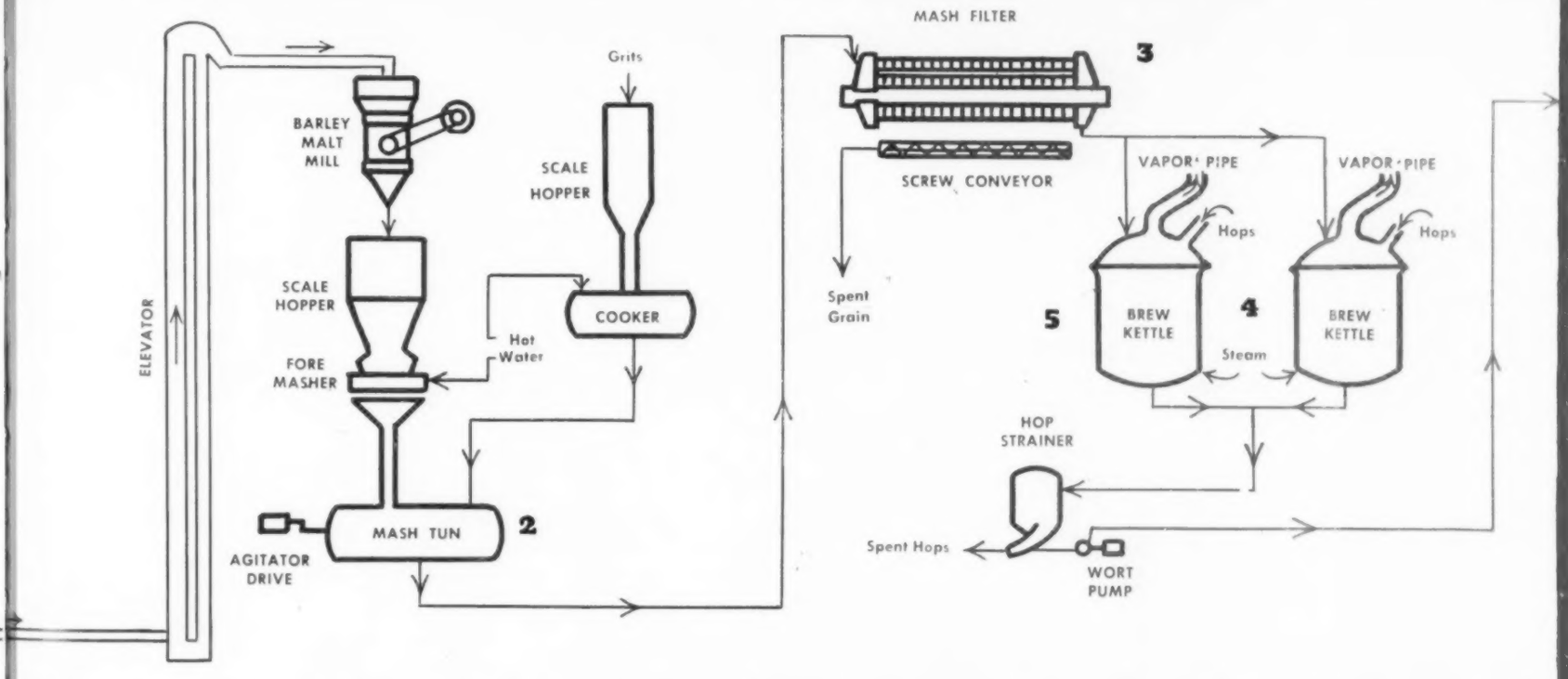


3 Wort from the mash tuns is passed through 60-chamber filter presses to remove undissolved grain. Spent grain is sold for use as cattle feed

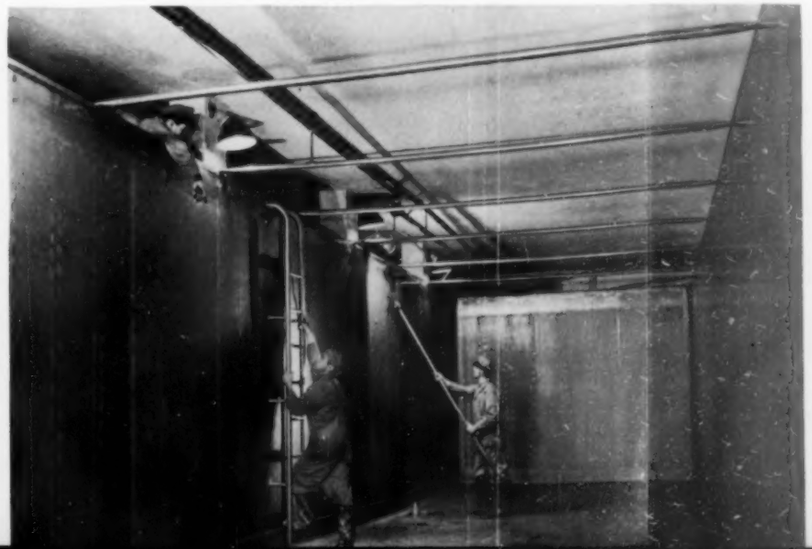
5 In the brew kettles wort is boiled, concentrated and flavored with hops. Steam is used for brewing. The finished product is a malt extract

7 Wort and ye
the extract is co



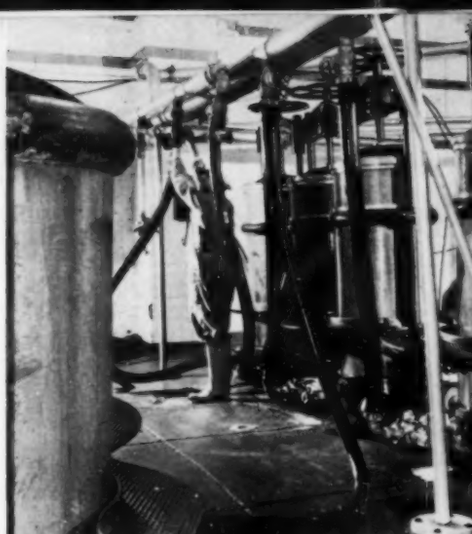
4 Clear wort from filters flows to large copper brew kettles. Of the four seen here two (foreground) are of 400-bbl. capacity and others are 800-bbl.

6 Hot wort from the collecting tank is cooled and yeast is added. Fermentation begins in stainless steel starting tanks. One shown here is being cleaned after use

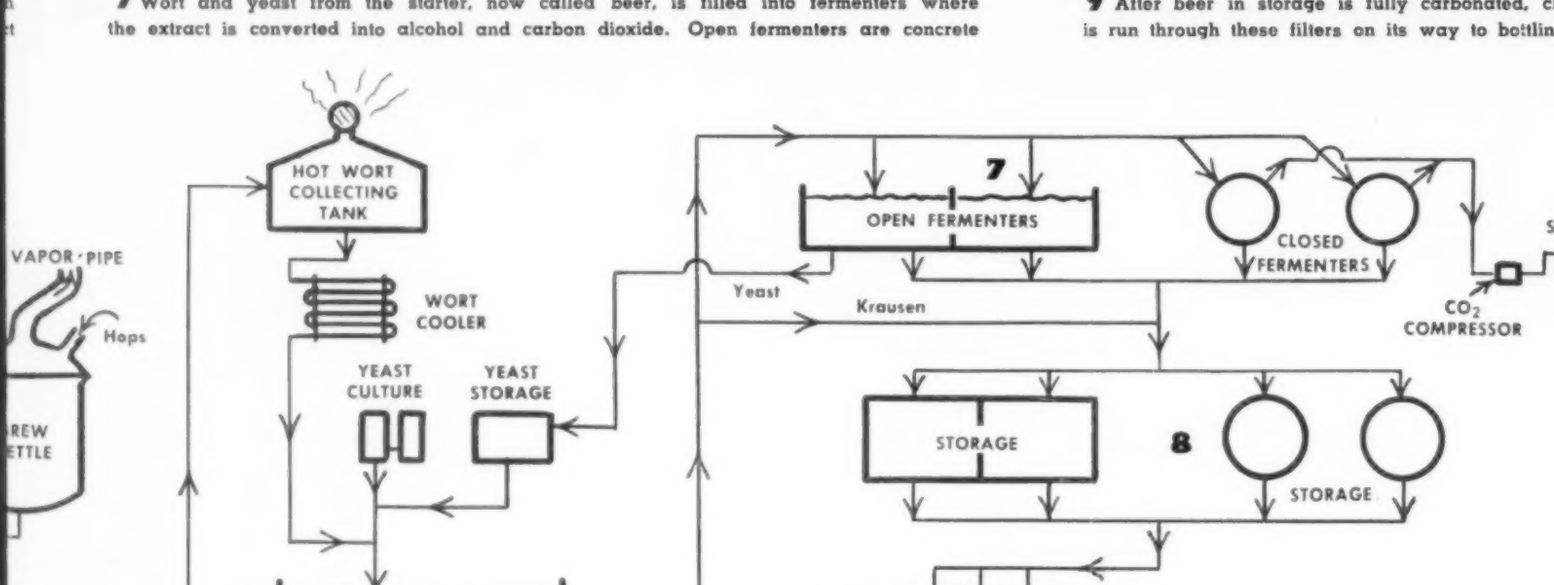


8 C
adde

7 Wort and yeast from the starter, now called beer, is filled into fermenters where the extract is converted into alcohol and carbon dioxide. Open fermenters are concrete



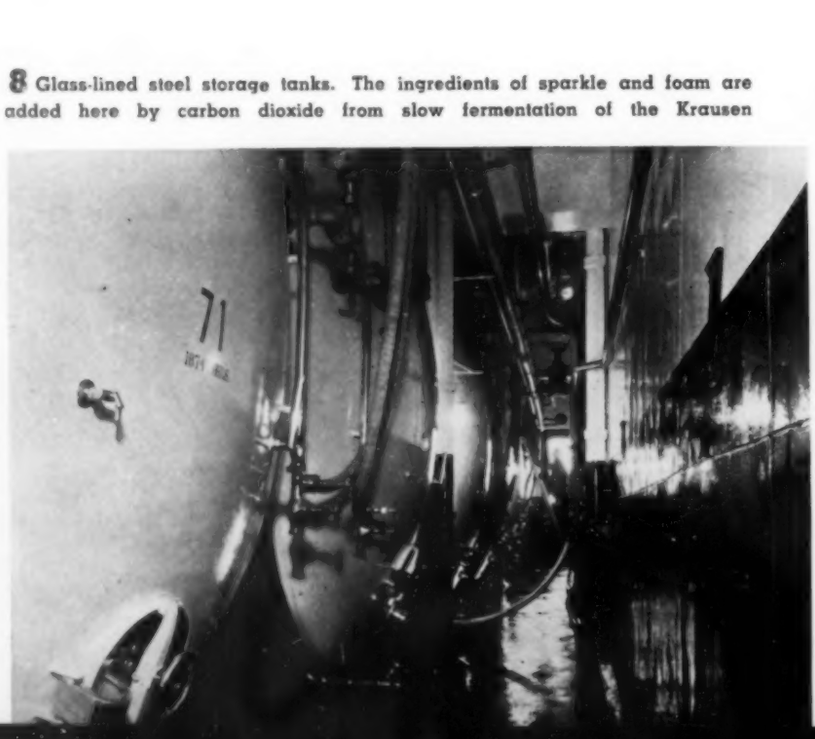
9 After beer in storage is fully carbonated, cl is run through these filters on its way to bottlin



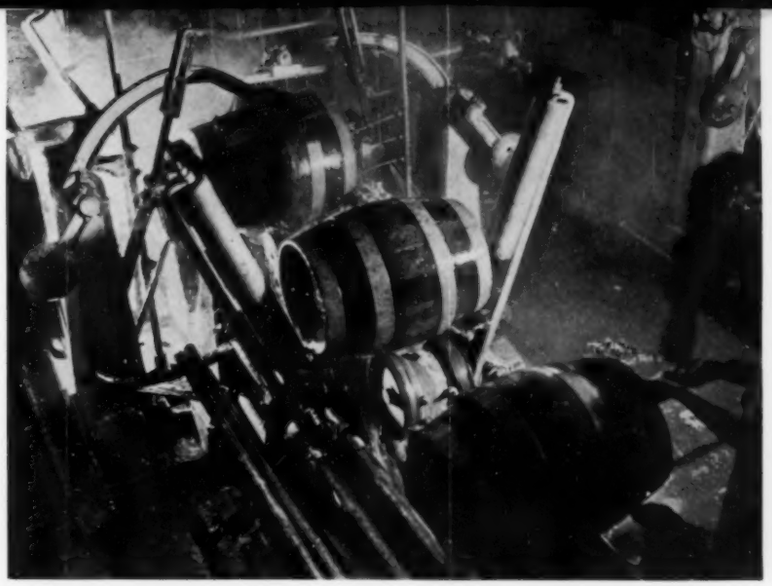
Fermentation
ed after use

8 Glass-lined steel storage tanks. The ingredients of sparkle and foam are added here by carbon dioxide from slow fermentation of the Krausen

10 Bottle washing, filling and capping operations. soakers, after being filled and crowned, are conv

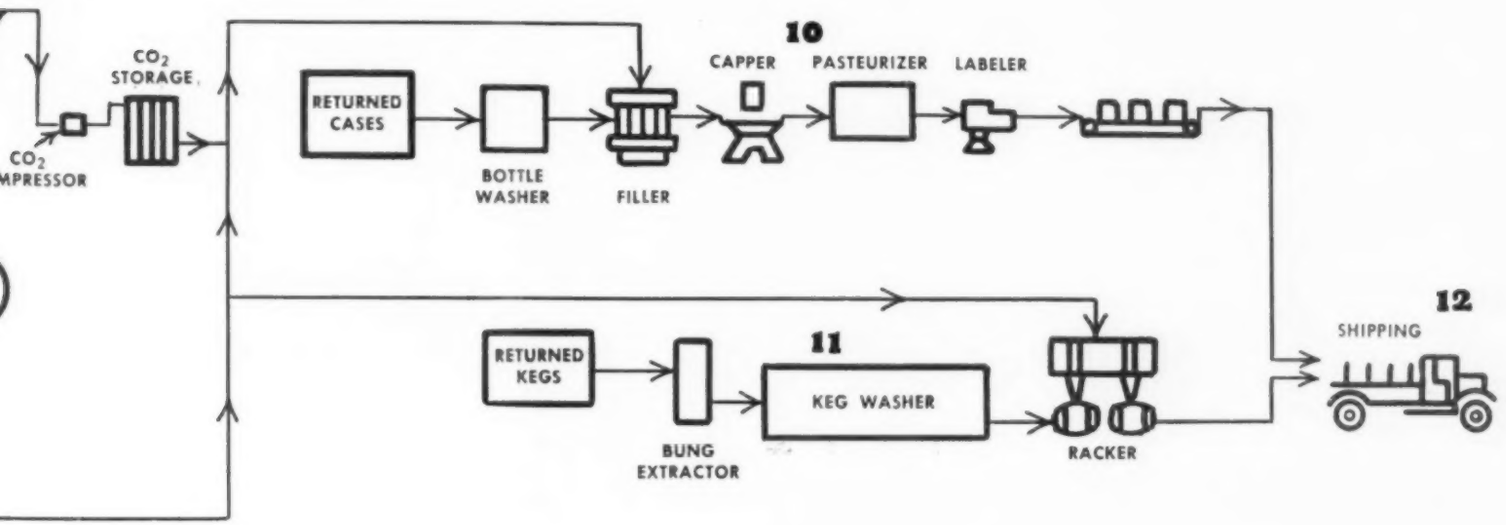


arbonated, clarified and mellowed, it
ay to bottling and racking operations



11 Six keg washers, operating at constant speed, scrub and clean returned kegs on their way to one of 26 filling arms in the racking room

A *Chem & Met* FLOW SHEET

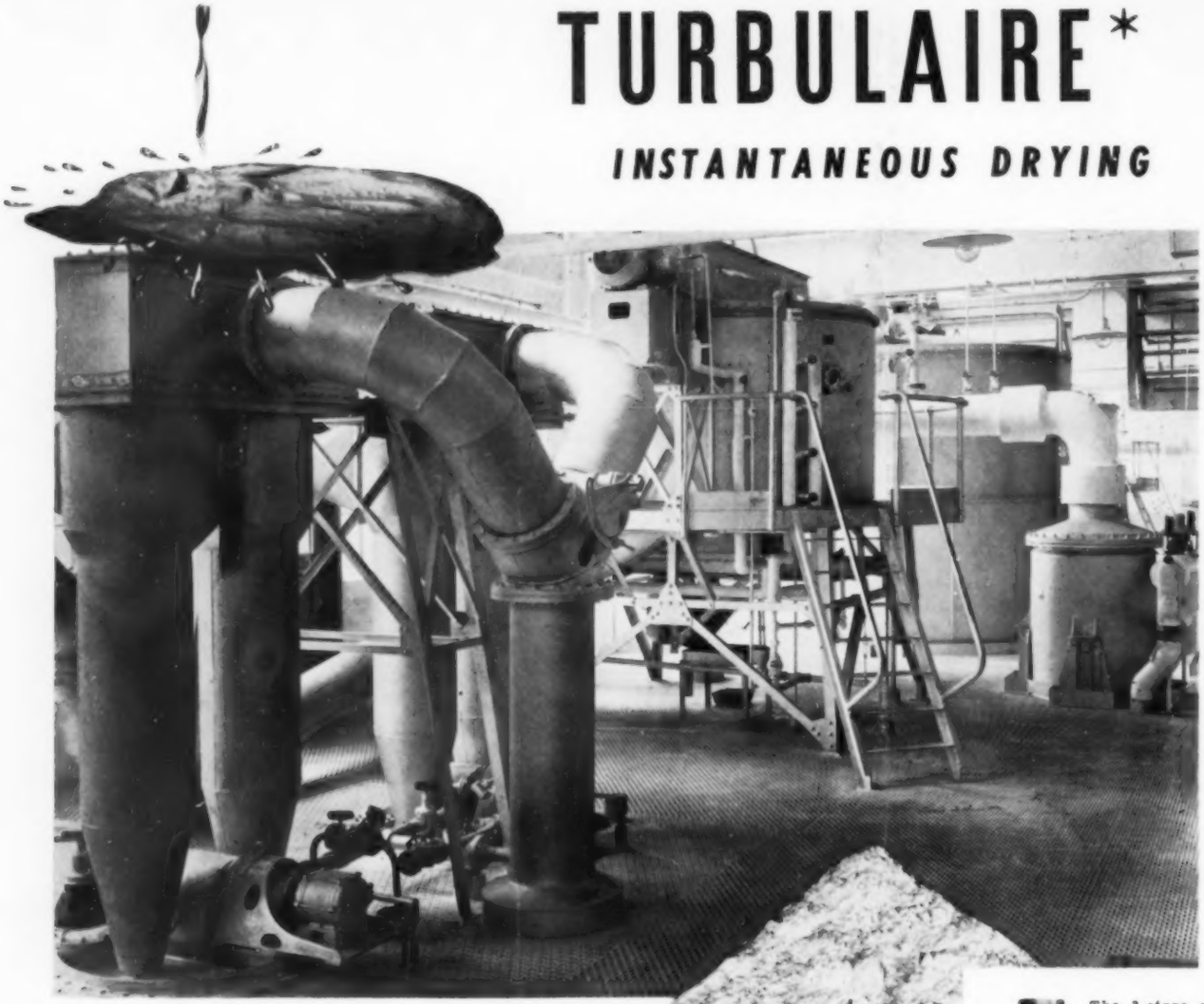


g operations. Bottles from a battery of six washers and
ed, are conveyed to pasteurizers and labeling machines

12 Loading the finished product. The Schaefer market is highly localized and is served almost entirely by the company's own large fleet of trucks

TURBULAIRE*

INSTANTANEOUS DRYING



HAS A NEW IMPORTANCE IN TODAY'S PRODUCTION

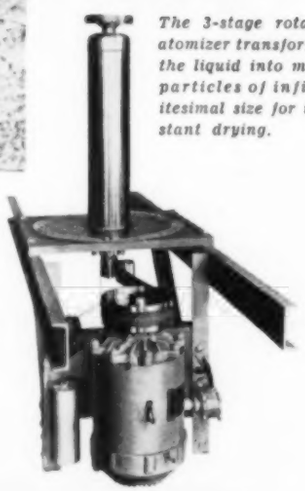
• Turbulaire Spray Dryers provide instantaneous processing of solids from suspensions, solutions or thin slurries to speed the production of essential materials. Careful engineering and precision manufacture make possible the production of a spray dried product having uniform physical and chemical properties.

• Turbulaire Spray Dryers are available in sizes conforming to the character of the product to be dried and the volume to be handled.

SEND FOR BULLETIN

• Western Precipitation Corporation maintains complete facilities for making test runs. One pint is sufficient for a preliminary examination to determine the advisability of spray drying it. Why not send a small sample of your material for a preliminary report.

*TUR-BU-LAIRE



The 3-stage rotary atomizer transforms the liquid into mist particles of infinitesimal size for instant drying.

WESTERN PRECIPITATION
CORPORATION

Engineers, Designers and Manufacturers of Equipment for Collection of Suspended Materials from Gases and Liquids

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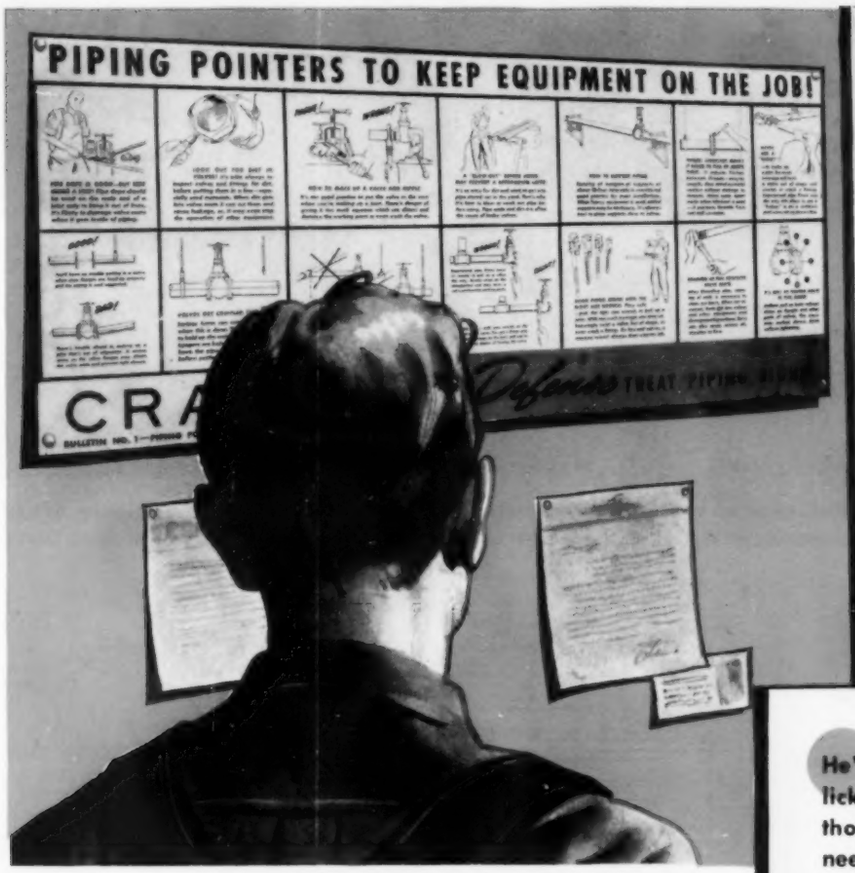
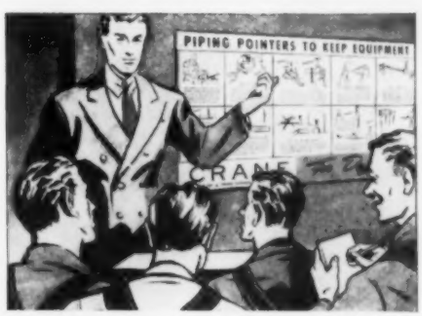


He'll work his head off in the plant to lick the Japs and Jerries. But he—and thousands of his brothers in industry—need help in keeping your plant *fit* for today's triple-shift production job. To provide that help—for him and for YOU—Crane Co., many months ago—established a vital new service for American industry . . . the Crane "Piping Pointers" shop bulletins.

Helpful Hints for Promise-Beaters

KNOWING HOW to choose the right valve for a particular service may make all the difference between smooth-flowing production and a costly interruption. "Piping Pointers" give practical hints on valve selection—hints that prevent many piping troubles—*keep equipment on the job!*

WRENCHES CAN BE DEADLY enemies of production if wrongly used. Because piping equipment must *stay* on the job today—because replacements waste time—waste critical metals—these Crane shop bulletins are showing maintenance crews in thousands of plants how to care for valves.



TRAINING NEW MEN for piping maintenance—helping veterans to *"brush up"* on modern methods—is one of the jobs Crane "Piping Pointers" are doing. Subjects range from how to open and close valves to how to prevent water hammer—all adding up to better piping, more production!

★ **OFFERED FREE AS AN AID TO VICTORY—"Piping Pointers" are available *free*—on request—from your local Crane Representative—or by writing to the address given here.**

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Petro-Chemicals

THE NEW ERA FOR THE PETROLEUM INDUSTRY ALREADY LAUNCHED AND WELL ON ITS WAY . . .

Typical "PETRO-CHEMICALS" already in production:

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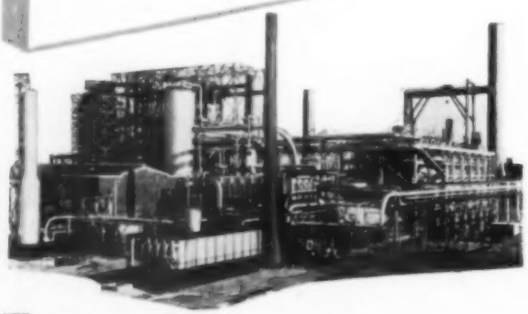

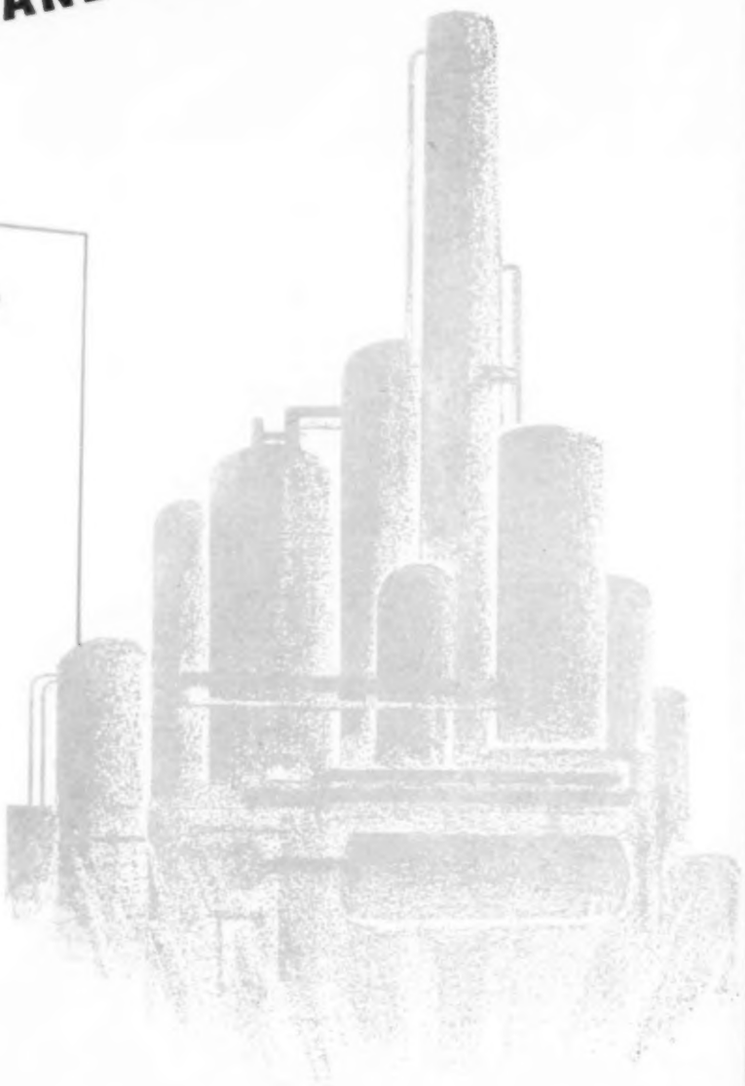

The role of the refinery in this new era of "petro-chemicals" is now fairly well defined. It can look forward to:

1 . . . making raw chemicals or intermediates for other industries to use as processing agents; or

2 . . . making finished chemicals for the general public or for industrial use.

No straight line can be drawn separating the interests of oil refineries from those of other processing plants. But one thing is sure. The chemicals now being produced from petroleum are prophetic of the opportunities lying ahead for the petroleum industry.

The Badger Company is exceptionally qualified to serve the industry on petro-chemical projects. It is strongly staffed with engineers and constructors who have had years of experience in the design and construction of chemical as well as petroleum plants and equipment.

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Engineers and Constructors Specializing in Petroleum and Chemical Plants and Equipment

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CHEM & MET NEWS

RADIO TALKS TO DESCRIBE WAR WORK OF ENGINEERS

On July 16, the National Broadcasting Co. initiated a program which will include a series of eleven radio talks dealing with the contribution of engineers to the prosecution of the war. This series is sponsored by the combined engineering societies. The first address on the subject of blackouts was made by Samuel G. Hibben of the Westinghouse Electric & Mfg. Co. The remainder of the program as at present outlined includes: July 23—"Protection Against Incendiary Bombs and Gas", Sidney D. Kirkpatrick, president of the American Institute of Chemical Engineers and Dr. Arthur B. Ray of Carbide & Carbon Chemicals Corp.; July 30—"The Resistance of Structures", Prof. H. E. Wessman, New York University and Walter D. Binger, Commissioner of Boro Works, Manhattan; Aug. 6—"The Navy. Ships." Admiral S. M. Robinson; Aug. 13—"Dry Docks and Ship Repair Bases", Rear Admiral Ben Moreell; Aug. 20—"Tanks and Tools" prepared by Chrysler Corp.; Aug. 27—"Airplanes" prepared by Wright Aeronautical Corp.; Sept. 3—"Petroleum Production", Robert E. Wilson, president, Pan American Petroleum Co.; Sept. 10—"Power, Hydro, Steam, Electric", Glen B. Warren, General Electric Co.; Sept. 17—"U. S. Engineers Corps In Peace and War"; Sept. 24—"Communications in Action".

VICTOR CHEMICAL SPONSORS PHOSPHORUS EXHIBIT

The Victor Chemical Works has given to the Museum of Science and Industry at Chicago, a permanent exhibit which tells the story of phosphorus and pictures the role phosphorus compounds play in serving mankind. The exhibit comprises an animated production panorama, complete with miniature steam shovels in action, model furnace, condenser, storage tanks, precipitator house, burner, etc., which show the manufacture of phosphate from the raw material to its conversion into phosphoric acid. Elemental phosphorus is burned in a transparent furnace and drawn into a vertical spray chamber in which the dilute acid runs down the side and is continuously drawn off. The furnace is designed with an underfeed and under hydraulic pressure the phosphorus is fed upon a disc hearth where it burns from the time the exhibit opens until it closes.

CHEMICAL COMPANIES CHARGED WITH ANTI-TRUST VIOLATION

On June 26, indictments were returned charging several chemical concerns and many officials of these concerns with violation of the anti-trust laws. Each indictment specified a particular chemical and charged that the companies named conspired to fix and maintain prices and control production and distribution. The chemicals named were chromic, formic, muriatic, oxalic, sulphuric acids and bichromate of soda and potash.

The companies involved were American Cyanamid & Chemical Corp., Atlas Powder Co., The Davis Chemical Co., The Martin Dennis Co., Dow Chemical Co., E. I. du Pont de Nemours & Co., General Chemical Co., Harshaw Chemical Co., Innis, Speiden & Co., Monsanto Chemical Co., Mutual Chemical Co., Natural Products Refining Co., New Jersey Zinc Sales Co., Oldbury Electro-Chemical Co., Pennsylvania Salt Mfg. Co., Prior Chemical Co., F. S. Royster Guano Co., Southern Agricultural Chemical Corp., and Victor Chemical Works, Stauffer Chemical Co., Standard Oil Co. of N. J.

POWER SHOW WILL BE HELD AT GRAND CENTRAL PALACE

The Fifteenth National Exposition of Power and Mechanical Engineering will be held at Grand Central Palace, New York, from Nov. 30 to Dec. 5, under the management of the International Exposition Co. Irving E. Moultrop will again act as chairman of the advisory committee with John H. Lawrence as vice-chairman. The management early in June announced that more than 125 companies had engaged space. Exhibitors are planning displays that will help the war production program by showing how to get more out of existing equipment, ways and means of preventing shutdowns and insuring continuous operation.

HERCULES DONATES MEDAL FOR PLASTICS DEVELOPMENT

The John Wesley Hyatt medal, to be awarded to the individual who makes the most significant achievement in the plastics industry, has been completed by Paul Manship, noted artist and sculptor. The medal, to be cast in gold, will be awarded annually with $1,000 in cash by the Hercules Powder Co.

The obverse of the medal bears a profile relief of John Wesley Hyatt, founder of plastics with his application of nitrocellulose to this use. The reverse bears a Grecian urn symbolizing the intellectual achievement of the award winner, wheels symbolizing the mechanical ability necessary to form the plastic, a chemical retort symbolizing the chemical origin of plastics, and dividers and triangle symbolizing plastics design.

RESEARCH ON NICKEL RESUMED AT MELLON INSTITUTE

The International Nickel Co., Inc., has resumed investigational work at Mellon Institute of Industrial Research, Pittsburgh, by the establishment of an Industrial Fellowship that began operation on July 1. This Fellowship is concerned with a comprehensive program of scientific research on certain problems in the chemistry and technology of nickel, embracing particular attention to the preparation, properties, and uses of nickel compounds, especially organic derivatives. Dr. John Gilbert Dean, a physico-organic chemist, is the incumbent of this Fellowship.

Northwestern's New Technological Institute, looking out on Lake Michigan from Evanston, Ill., comprises over 10 acres of floor area that will house chemical, civil, electrical and mechanical engineering as well as the departments of chemistry and physics. It was made possible by a gift of $6,735,000 from Walter P. Murphy, chairman of the board of the Standard Railway Equipment Mfg. Co., who has long been interested in cooperative education in which the student divides his time between school and factory. Chemical engineering, including metallurgy, is housed in 28,000 sq. ft. in the 3-story south central wing of the building. An outstanding feature is a unit operations laboratory 70 ft. by 56 ft. with a 2-story bay and a 3-story well for larger scale equipment.

News from Washington

WASHINGTON NEWS BUREAU, McGRAW-HILL PUBLISHING CO.

More complete control of all types of industry activity is being established step by step through enlarged or reconstituted official units in Washington. O.P.A. is becoming a complete price-fixing bureau. Practically all equipment and supplies are controlled now under either priorities or the P.R.P. quarterly allotments. Even manpower regulations are beginning to be felt.

Overshadowing all other war factors of concern to process industry are the shortages in raw materials. A few months ago it seemed as though all of the metals were being put into ships, tanks, guns, and planes. But now that objective is really being sought. As a consequence, almost no metal is going to be granted for any other purpose except to making of the material itself.

Bureau Personnel Changes

Important changes in the personnel and organization of the U. S. Bureau of Mines and of the Bureau of Agricultural Chemistry and Engineering took effect July 1 or thereabouts. These modifications in some cases radically shift important relationships between process industry and these two great research bureaus of the Government.

The Department of Agriculture is now functioning for all types of research through Agricultural Research Administration. To head the chemical and chemical engineering work of that agency, Dr. Orville E. May has been recalled from the post of Director of the Northern Regional Laboratory at Peoria, Ill., to become an assistant of A.R.A. Administrator E. C. Auchter. Horace T. Herrick, who has been Assistant Chief of the Bureau, goes to Peoria to take charge of the work which Dr. May leaves. Carl F. Speh succeeds Mr. Herrick in administrative responsibility at Washington. These shifts place men most conversant with war-time duties in these three important chemical positions.

Mines Bureau changes represent a breaking up of the old Technologic Branch into two major services. The Mining, Metallurgical, and Non-Metals Divisions of the Branch make up a new "Resources and Laboratories Service" which will be headed by Assistant Director R. S. Dean. Under him there will be three regional offices functioning for Western, Central, and Eastern areas.

The remainder of the Technologic Branch continuing under A. C. Fieldner will now make up the "Fuels and Explosives Service". Under this new operating agency there will be all of the activities previously included in Solid Fuels, Petroleum, Natural Gas, Explosives, and Helium Divisions or field activities. Neither the Economics Branch nor the Health and Safety Service are modified by this readjustment of technical work. The Coal Mine Inspection, Explosives Control, and Anti-Sabotage work will be continued under the direction of the Health and Safety Branch.

Manpower Program

Organization of the War Manpower Commission progressed rapidly during June. Outstanding technical men have been named to direct the important scientific and professional activities of this unit. The chief of the professional and technical employment and training division is to be President Edward C. Elliott of Purdue University. Trained in chemistry and for many years associated with engineering education, Dr. Elliott is expected to carry on aggressively plans for training as well as for placement of technical personnel where men will be most useful. The general executive officer of War Manpower Commission, Brigadier General Frank J. MacSherry, is also keenly aware of these technical problems. He is fully acquainted with the needs of the Army and Navy, but realizes equally well that industry must be staffed with technical men or it cannot produce the goods for war.

Equally significant progress has been made in the organization of Army Specialists Corps. The director general who has the relative rank of Major General is Dwight F. Davis, former Secretary of War. There will be three deputy directors, one of them, the distinguished engineer, William O. Hotchkiss, president of Rensselaer Polytechnic Institute. Dr. Hotchkiss will have complete charge of the scientific and technical personnel in his status as Deputy Director with the relative rank of Brigadier General.

Professional men generally believe that this group of appointments insures a constructive and intelligent handling of technical personnel problems within both of these new units.

New Deferment Rules

Two criteria, of about equal importance, will now determine the status of the individual eligibles for military service. One test will be the job filled. The other test will be the family status.

Those who have essential war jobs will wherever possible be held in them. The degree of importance of the job will be considered first and second the difficulty of getting a replacement individual.

The new Selective Service law signed by the President late in June gives a new emphasis to the family status as the other element of classification. There will be, in effect, four groups: single persons; those with dependents other than wife and children; men with wives but no children; and, finally, those with wives and children. The effort will be to take these groups of individuals in each community in this sequence. Congress has decided that matter rather definitely in the new law. In other words, the Act places great emphasis on protecting family units so far as possible.

When family status and job status come in conflict, no one knows what the answer will be. In these, as in other matters, the local boards make the decisions. Local board findings are subject to state and higher review. But generally the policy thought wise by the local boards will govern.

Fat, Soap, Glycerin

Plans for saving of household fats are being made along two lines. The butcher is being urged to cut a very much larger percentage of the fat from meat before delivery to the housewife. The fat from such scrap collection will readily be gathered for rendering and reclaiming.

Direct saving of fats in the home is also planned. This has been tried out experimentally in a few communities during June. The housewife is asked to pour bacon grease and fat residues from other cooking into a clean can or container until she has at least a pound accumulated. This is then taken to the butcher shop where she is given a small credit or cash refund. Accumulation of the household fats so gathered by the butcher parallels the scrap trimming collections.

The objective is, of course, additional fat for soap manufacture and fat splitting establishments. It is hoped that in the aggregate a substantial percentage of these industries' raw material needed may be so assembled.

During June there was increasing evidence accumulating in Washington that a serious backing up of soap was occurring throughout the wholesale and retail trades. Apparently, housewives have begun to use up hoarded supplies and are thus making fewer purchases currently. Warehouse stocks have in a few cases reached embarrassing proportions. As yet no general slow-down of soap manufacture has been necessary.

Were it not for glycerin requirements all of these factors would not worry official Washington. There is a question as to whether continued large scale soap-making can be encouraged merely to get the glycerin byproduct when a prospective shortage of total supply of fats for domestic and Lend-Lease purposes is anticipated in 1943. This shortage will apparently not affect butter or seed oils but may become much more serious with respect to fats that are more logical substitutes for the unavailabel coconut oil. (See *Chem. & Met.* June 1942, page 75.)

Fertilizer Program

Complete coverage of United States in the program for simplification of fertilizer formulas is assured. Making of uneconomical grades will be discontinued. By the end of July it is expected that a very limited number of formulas will be established for each region or state. This will give a

maximum flexibility in marketing on the basis of agreements reached by the agronomists, public officials, and the manufacturing industry.

The nitrogen supply for the next fertilizer year remains a matter of great uncertainty. No one, not even highest government officials, can accurately forecast whether ammonia production can be built up fast enough to permit allocation of that chemical in any significant quantity for fertilizer making. If some other units of ammunition make-up are short, or if ship transport prevents rapid movement of ammunition to fighting fronts, there may be a little surplus of ammonia for this fertilizer usage.

Indirect methods of getting high nitrogen meal from oil seed crushing into the fertilizer stream are proving necessary. That nitrogen costs substantially more per unit than normal types. But O.P.A. refuses to recognize this by allowing increased prices. Hence, use of seed meals in mixed fertilizers will be definitely limited for financial reasons.

Farmers are being urged to take at least 1.5 tons of seed meal for each ton of cotton seed which they take to the oil mills for crushing. Thus, they would be able to mix meal with commercial fertilizer or apply it separately and get desired nitrogen fertilizer in nearly adequate quantities. The extent of cooperation in this program is, of course, very uncertain at this stage.

Chemical Miscellany

Solvent Salvage—The industrial salvage executives of W.P.B. are urging careful review of all plants to determine whether more chemical solvents and oils may not be reclaimed. In view of the shortage of alcohols, chlorinated hydrocarbons, esters, ethers, and other organic materials, it is desired that make-up requirements for processing be reduced to a minimum. More effective operation of vapor recovery systems, even the installation of a little new equipment is encouraged, but makeshift methods of salvage are going to be necessary in most cases as priority for recovery equipment is not likely in most cases.

Over-time Calculation—Few chemical companies are paying anything close to minimum permissible wages under the Fair Labor Standards Act. They may, therefore, often be interested in the U. S. Supreme Court decision ruling that over-time payments must be calculated on the assumption that regular weekly or monthly wages apply for the normal work period. In some cases there are formal agreements indicating hourly rates and minimum weekly earnings. Only in those cases can such lower hourly rate be used in calculating one and one-half times normal wage when paying for over-time. If the average hourly compensation is high, the over-time payment must be one and one-half times this rate in all cases, except where labor contracts provide otherwise.

Platinum Control—Some platinum has been slipping out of the United States into the hands of the Axis. To prevent more, it is now required that all platinum transactions be reported under W.P.B. Purchasers not conforming to the regulations are also subject to penalty.

New Freight Costs—Where price ceilings apply to goods on a delivered basis it is not permissible, according to O.P.A. rulings, to increase the delivered price to take account of freight rate raises. It is expected that this element of added cost be absorbed by the shipper unless he gets special authorization for a new price schedule.

Fuel Inventories—Every possible encouragement is given by Washington to industries building up stocks of coal and coke. Care has been taken to amend inventory regulations which might otherwise technically have discouraged large inventory accumulation of fuel.

Conventions Canceled—The Office of Defense Transportation is urging that fairs, expositions, and even conventions be canceled to minimize travel. Only where gatherings deal with important war undertakings is it desired to have normal meetings. A number of important organizations have canceled or radically modified their annual convention plans. For example, Association of Official Agricultural Chemists will hold no convention. American Gas Association has canceled its plans for a convention at San Francisco but may hold a war conference instead at some more accessible point. Many other convention changes are contemplated.

Sponge Iron Probed — Senator O'Mahoney has charged that the steel industry has been deliberately suppressing development of the sponge iron process in order to protect its large capital investment in the ferrous metal business. This is just one more case in which fragments of information, apparently presented by propagandists, have been used for attacks on certain industrial agencies. In this case government technical men fail altogether to support the charges. But they have had a big newspaper "play" nevertheless.

Tariff Canceled —Cancelling of tariff levies on imports of government goods will not affect prices paid for comparable materials within the United States. This is the assurance of Secretary of Commerce Jesse Jones in commenting on the President's Executive Order. Under that order imports are now made by R.F.C. and its subsidiaries, Treasury, War, and Agriculture, as well as Navy, without payment of duty.

Fewer Chemical Cans—Many of the chemical process industries are feeling the pinch which has applied for several months to foods. Under modified Order M-81 many commodities, including the following, can no longer be packed in tinplate or terneplate containers: Paints and related products; health supplies, except chloroform, ether, and a few others; alcohol, acetone, and a dozen other important chemicals; cements; fly spray; dry cleaners, etc. This tightening up on the use of tin is only one more important step toward extensive restrictions that are certain to come as prospective shortages become more acute.

Seasonal Insecticides — The pricing of goods which have a seasonal market, like insecticides and fungicides, will be according to a new policy. This was first illustrated in Price Regulation No. 144, effective May 18. It recognizes the average margin of price above cost in the busiest month of last year as determining the mark-up permissible above this year's costs. Makers of any commodities which must be priced under the seasonal regulations will do well to study this first order as a guide.

Mexican Deals—Purchase of copper, lead, and zinc from Mexico at a special bonus price has been undertaken by Metals Reserve Co. The result is expected to be a huge increase in nonferrous metal production in that country. The agreement governing this arrangement provides for labor stabilization, control of transport and production costs, and other helpful assurances from Mexico. Also current during May were extensive negotiations for a new trade agreement. Many tariff cuts by the United States have been under debate in those proceedings.

Casein Use Urged—To conserve other industrial materials which are more scarce, the Bureau of Industrial Conservation of W.P.B. is urging much more use of casein as adhesive, in emulsions, and for numerous other purposes. Saving of plastics and plastic raw materials which are more scarce is the objective.

CHEMICAL FRATERNITY ELECTS NEW OFFICERS

Alpha Chi Sigma, the professional chemical fraternity has elected Harold P. Gaw, American Rolling Mill Co., Middletown, Ohio, to succeed Walter S. Ritchie of Massachusetts State College at Amherst. Other officers elected at the biennial conclave held in Chicago June 19-22, include, first vice-president, A. Watson Chapman, Celotex Corp., New Orleans, in charge of professional alumni chapters; L. W. Van Doren, Basic Vegetable Products Co., Vacaville, Calif., second vice-president in charge of collegiate chapters; and Clyde B. Hutchison, Champion Coated Paper Co., Saundersville, Ga., national ritualist.

John R. Kuebler, Indianapolis, for many years national secretary-treasurer and editor of the fraternity's magazine, *The Hexagon*, now assumes full-time duties with the organization.

ARMY OFFICERS AND ENLISTED MEN VISIT PLANT OF HOOKER ELECTROCHEMICAL CO. AT NIAGARA FALLS

THE first of a series of Army Visitations to war production plants in Niagara Falls, was held at the main plant of the Hooker Electrochemical Co. on May 26. A large group of enlisted men went through the various departments, talking with the chemical plant operators individually. Out of these informal discussions, both soldiers and operators gained a clearer understanding of the others' part in the war effort.

General Paul X. English, Chief of Industrial Service of the Chemical Warfare Service, headed the staff of officers who joined in the visit, and included Col. Harry A. Kuhn, Chief of the New York CWS District; Col. Floyd D. Carlock, Commanding Officer of Fort Niagara; Lt. Col. Frank R. Johnson, head of the Niagara Falls CWS Division; and Lt. Col. Leslie Sutherland and Major Cummings, both of the New York CWS District. General English was accompanied by Major William Brooks, and Captain Cleveland J. Bishop representing General Sommervell of the Service of Supply.

Harry M. Hooker, president, and Edwin R. Bartlett, executive vice-president, joined the plant service committee as hosts to the visitors. Wives and children of the plant employees, especially invited for the occasion, swelled the crowd attending the general exercises and speeches in the plaza.

When the tour of the plant had been completed, the soldiers, officers, and workmen moved into the plaza in front of the administration building to hear a talk by General English.

In his address General English said: "This is a new kind of war. It is a war both of machines and of men. The armies over which the Nazis rolled were not composed of weaklings or cowards. The Dutch, the Jugo-Slavs, the French, the Belgians, the Poles, the Greeks and all the other brave peoples who are enslaved by the Nazi terror, wished to defend their homelands, but with what? No amount of bravery, no amount of love of country, no amount of willingness to do or die could long stand up against armored force, without armored force to counter with. That is why we in the army consider the workers as soldiers of production in this war.

"Your work is just as necessary as the work of the man with the gun. Without it, there can be no gun—and then—no man. The soldier faces hopeless odds, unless you keep him supplied. War has become so mechanized that against the eight or ten workmen it took to enable a soldier to pull the trigger in the first World war, it now takes 20 or more workmen.

"This is not only a war of machines, but it is also a war of chemicals. The steel and metal which the machine makes need to be filled with chemicals. Chemicals must treat a host of materials to protect them against war damage. Chemicals are vital in the course of almost every industrial process, to make munitions. Incendiary bombs are filled with chemical materials. These are being used on every hand.

"General Doolittle told the Chemical Warfare Service, and the fact was published by the War Department, that he was highly impressed by the workmanship and action of the incendiary bombs he and his heroic fellow soldiers dropped on Tokyo. Inflammable Tokyo was your target as well as General Doolittle's and his men. It was your military objective, as much as the Army's. Doesn't it give you a sense of patriotic pride and personal satisfaction to realize that if it had not been for your handiwork, the treacherous Japs would not have received such an effective dose of their own medicine?

"In this war, our preparations and our actions must be complete. There can be no flaws in our armour; no hole through which the enemy can drive a wedge. One such hole, no matter how small, may well prove fatal. We are engaged in a titanic struggle with powerful enemies, but no enemy is greater than ourselves. Complacency and over-confidence can defeat us as they defeated France. Selfish internal bickering and discontent are as effective as bombs and bullets. The factory where time is lost is a factory half bombed. Every minute of idleness or of an idle machine adds to the length of the war.

"Americans are used to playing as a team. You and the Army and Navy are a team. You are the passers, we the receivers. You give us the ball, and we will carry it. It takes a very poor judge of the game not to recognize the equal importance of the passers and the receivers. Americans are too adept at games not to see that clearly.

"No matter how tough the task is, how uninteresting it may seem to you, and how many hours you have to put into it, just bear in mind that somewhere, someone in uniform is waiting for what you turn out. If it doesn't arrive on schedule, it may mean the difference between life and death to him. And that person may be a father, or a brother, or a young fellow from this very plant.

"You are fortunate in being able to do your particular job in surroundings such as these. You don't have to dodge bombs and bullets in stinking swamps, or on blazing desert sands. You have regular hours. You can wash up and go home at night to loved ones, and enjoy the comforts of your own home. The soldier can't. He doesn't punch a time clock, and his wartime pay check is so much smaller than yours. He is fighting for his country under many more disadvantages than you have. He is bearing a very heavy pack, but he does not envy you your modest comforts; he wants you to enjoy them if you will but roll the material out to him in the field.

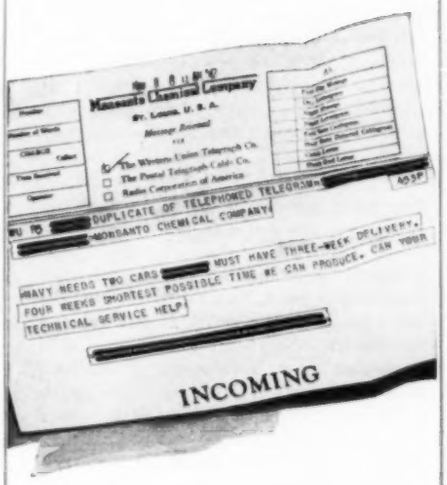
"The Godless and inflated egotist Hitler has boasted that a free people can't produce. He has challenged the democracy of free men with a drab collectivism of slogan chanting robots, but Americans are from Missouri, and he will have to show us! Each of us—workers and soldiers alike—will see to that. Your work clothes are your uniform, as dignified and as important as that of a combat soldier. We, the soldiers, tell you that.

"General Porter, Chief of the Chemical Warfare Service, has said: 'This is a war of production. Whichever side produces the most will eventually win.' There is time only for toil. This means sweat and sacrifice on your part today, to prevent unnecessary blood-shed and death on the soldier's part tomorrow.

General English receives the General's salute from U. S. Army troops and chemical workers at opening of Army visitation at plant of Hooker Electrochemical Co.

The Navy asked the impossible— and got it...*in a week!*

One of a series of cases from the files of Monsanto's Technical Service Department which show how skill, experience and ingenuity can solve many critical wartime production problems. For obvious reasons names and any identifying clues have been omitted.

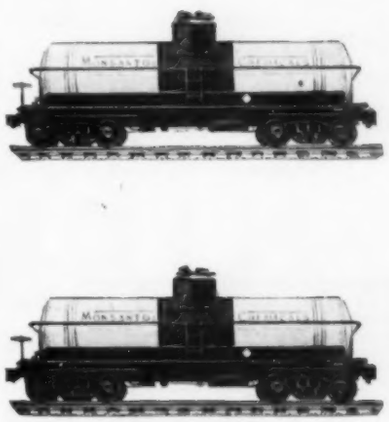


1. This is the wire a hopeful sales correspondent recently marked "RUSH—Technical Service, please handle!" It was signed by a Monsanto customer of long standing.

[redacted] was a product manufactured by the customer largely from raw materials supplied by Monsanto. To produce the quantity needed and to meet Navy specifications would ordinarily require a series of relatively simple but time-consuming operations.

2. But in two days Technical Service had worked out a new manufacturing process telescoping several of the previous steps into one...on the third day production was started . . . and within a week, two tank cars of the product were on their way to the Navy, *two weeks ahead of the specified delivery date!*

Obviously not all the problems referred to Monsanto Technical Service these hectic days are so quickly or happily solved.



3. You will find, however, that two factors often give Monsanto technical men a head start towards a solution; (1) a thorough understanding of *your* basic problems; (2) a broad knowledge of their *own* business which springs from the very breadth and variety of Monsanto's chemical manufacturing experience. Finally, you will find them especially eager to help on war production problems. MONSANTO CHEMICAL COMPANY, St. Louis, U. S. A.

MONSANTO CHEMICALS

"E" for Excellence . . . denoting the highest service accomplishment of the United States Navy . . . flies over Monsanto "in recognition of production of ordnance materiel vital to our national defense." In addition to the Ordnance flag and "E" pennant, Monsanto has now been awarded the All Navy "E" burgee, at left, "for excellence in war production."

It means unstinting contribution by both labor and management to a degree never before attained, but which must be reached if we are going to win.

"You will, I know, cheerfully deny yourselves many a peace-time privilege in order that the men at the front may carry on, and in addition to this, you will work like demons to see that they have the materials with which to win. Our country is like that. Every crisis makes it more determined to gain the victory, and this time it will be satisfied with no patchwork victory—only with a conclusive one, for this is no war among Nations, it is a world showdown between free men and slaves.

"We shall keep the soldier's faith," promised General MacArthur. Here and now we dedicate ourselves again that we *will*, you the workers, and we the soldiers."

R. Lindley Murray, vice-president in charge of development of the Hooker Co., presided at a dinner given to the visiting officers at the Niagara Falls Country Club with the executives of all the principal chemical plants of Niagara Falls. General English and other officers were introduced and spoke briefly.

RESTRICTIONS ON SALE OF NEW LABORATORY EQUIPMENT

Even the "simon pure" research laboratory must now prove that the work going on under its roof is related to the war effort if it is to be able to secure new laboratory equipment. This is the result of Limitation Order L-144 issued the second week in June. This order effects university and other private laboratories by prohibiting the sale or delivery of laboratory equipment which contain any of a long list of critical materials.

The critical materials listed in the order are "Aluminum, chromium, copper, iron, magnesium, molybdenum, nickel, steel, tantalum, tin, titanium, any alloy of said metal, rubber, neoprene, or other synthetic rubber, or non-cellulose base synthetic plastics".

Laboratory equipment containing these critical materials may be obtained when it is certified by the purchasing company that the equipment will be used only for the purposes permitted by the order. These uses are: 1. Research on, or production, analysis or testing of, materials. 2. Research by or for government agencies or lend-lease countries. 3. For training of personnel for the same. 4. For the necessary replacement of essential equipment in federal, state, county and city laboratories and in laboratories affecting the public health. 5. For necessary repair parts and operating supplies to maintain essential laboratory equipment. 6. For any use authorized by the Director of Industry Operations deemed necessary in the public interest.

E. R. Schaeffer, Chief of the Safety and Technical Equipment Branch will act for the Director of Industry Operations to determine uses to be permitted and he also will act as the Administrator of the Order.

FURTHER TIGHTENING OF BRITISH CHEMICAL CONTROL EASES SUPPLY PROBLEM

Special Correspondence

SINCE the beginning of this year few important changes have occurred in chemical prices in the British market, and when large contracts come up for renewal, further deliveries are generally agreed upon at unchanged quotations. This is in the first place due to the wide range of control and secondly to the successful efforts of authorities and producers to keep the producing costs within reasonable limits. Many consuming industries which normally absorb very large quantities of industrial chemicals are now subject to concentration of production and standardization of manufactures, with the result that their demands tend to decline. This applies equally to textile mills, potteries, glass factories, paint works and soap plants and cannot but have an even more profound effect on chemical markets in the future. There are still many products which are supplied in quantities only just sufficient to meet essential demands. Chromium compounds, yellow prussiates, barium chloride, oxalic acid, iron sulphate, acetone and formaldehyde are in very active demand indeed, but the position of sodium and potassium compounds generally is now easier.

It has even been suggested that the decline in demand for some industrial chemicals may enable the control authorities to take a somewhat more liberal attitude with regard to exports. It is true that licenses for exports of chemicals to certain destinations are now being granted more freely. At the same time the license system is tightened up. Board of Trade licenses are now required for exports to all destinations of potassium and sodium, antimony, tartrates, barium compounds, chromium compounds and preparations (except distempers, lacquers, varnishes, paints and painters' enamels, prepared or ready mixed), barium chromate and pigments containing barium chromate, pigments containing lead chromate, zinc chromate and pigments containing zinc chromate. The list is growing longer every month, and these most recent additions show that the authorities must keep the export trade under strict supervision.

Home trade control has been extended by a new order dealing with coal-tar. As from May 1, the disposal of all coal-tar products by distillers and importers has been subject to license. The Secretary for Mines has been authorized to give directions regarding the disposal, treatment, use and blending of coal-tar and coal-tar products. He has also issued price regulations for coal-tar acids, anthracene, and road tar. All wholesalers dealing with coal-tar products have been registered. The powers of the Coal-Tar Controller have been considerably increased by the new order, but some such move had been expected for a long time. It is not impossible that as the result of the new arrangements more coal-tar products will be available for exports to U.S.A., formerly an important buyer of British creosote, etc. Last year only small quantities of cresylic acid and some naphthalene were sent from England to U.S.A., and certain quantities of creosote were shipped across the Atlantic if required for essential war purposes. British coal-tar manufacturers would certainly welcome a larger export trade with the United States.

The steady increase in chemical production for war purposes has accentuated the labor problem of British industry, and there is every prospect that the organization drawn up to deal with the question will attain increasing importance. The basis of the present arrangements is the Essential Works Order which applies to the most important section of the chemical industry and imposes obligations on employers and employees. This has been supported by a scheme drawn up jointly by the Chemical Control Board, the Association of British Chemical Manufacturers and the Association of Chemical Employers — the so-called "ring-frame" scheme to ensure that no workers leave the chemical industry permanently. Regional labor supply committees of employers and employees have been set up to operate the scheme, and their work has been very successful. Women operatives have been entrusted with many jobs which were thought out of bounds for female labor before, and the satisfaction felt at their work will lead to the employment of more women. Nevertheless the labor position is likely to make increasingly heavy demands.

A chemical raw material which has greatly increased in significance as a result of the "Grow More Food" campaign is lime. A number of new limestone quarries recently opened in Scotland will more than double the total lime output in that country. It has been so difficult to keep supply abreast of demand that some unconventional lime materials are now being used. One of these is magnesium limestone dust, a material which contains 56 percent calcium carbonate and 37 percent magnesium carbonate and has an acid-neutralising value equal to that of English ground limestone. A quantity of between one and two-and-a-half tons is applied per acre.

The movement for increased use of producer gas in road vehicles has made important progress as a result of a government decision that as soon as possible 10,000 commercial road vehicles are to be equipped with producer gas apparatus of official standard design. A new improved type has resulted from experiments and is recommended for adoption by the Technical Committee on Producer Gas. That the idea of greater reliance on this form

of motor fuel is progressing was shown by a motion passed by the House of Lords calling for the conversion of 50,000 transport vehicles to producer gas propulsion. It is not intended to run the new producer gas lorries on charcoal or wood, but a suitable fuel is obtained by carbonizing selected types of coal at high temperatures without any further treatment. Use of this coal derivative has the further advantage that valuable by-products are obtained for chemical use.

Another substitute development concerns makers of chemical apparatus. Several new factories have been built recently to make equipment previously imported from Continental Europe. Among new apparatus at the disposal of British chemical manufacturers are platinum electrodes which combine increased strength with reduced weight and cost. New pottery plant and kilns have been installed for making chemical porcelain. Porous-bottomed crucibles are now made in Royal Worcester porcelain, Buchner funnels are made from a special heat-resisting chemical stoneware by the Royal Doulton Potteries.

The need to conserve sugar has led pharmaceutical manufacturers to pay increased attention to other preservatives. Chlorophenols and phenylmercuric acetate, boric acid, borax and saline, benzoic acid, sulphur dioxide, and formaldehyde are all being used to varying degrees. It is proposed to replace sugar by a tragacanth suspension of saccharin preserved with spirit of chloroform, while tragacanth in turn can be replaced by methyl cellulose, and glycerine by sorbitol. The latest—fifth—addendum to the British Pharmacopœia of 1932 which has just been issued provides for many new formulae obviously designed with a view to the saving of alcohol. Substitutes for alcohol will also be needed by makers of perfumes, toilet waters, cosmetics and shampoos who must no longer use it after June; hitherto they received one-quarter of their pre-war supplies.

The Ministers of Health and Supply have the question of extended control over the distribution of pharmaceutical preparations under consideration, and it is intended to reserve essential drugs for those who need them for essential purposes, thus reducing the big trade in proprietary medicines which has been built up by some chain-store and department retail houses. For the first time a limited quantity of crude botanical drugs imported under Lease-Lend arrangements from the United States has been distributed among British pharmaceutical manufacturers. The imported drugs include cascara sagrada (sold at 150s. per cwt.), ext. hamamelis (10s 6d per gallon), hydrastis (22s 6d per lb), leptandra root (1s 10d per lb), lobelia 2s 8d per lb), resin of podophyllum (27s 6d per lb), slippery elm bark (1s 6¢ per lb.) and wild cherry bark (9d per lb). The Botanical Drug Importers' Section of the London Chamber of Commerce have been appointed agents for the Ministry of Supply.

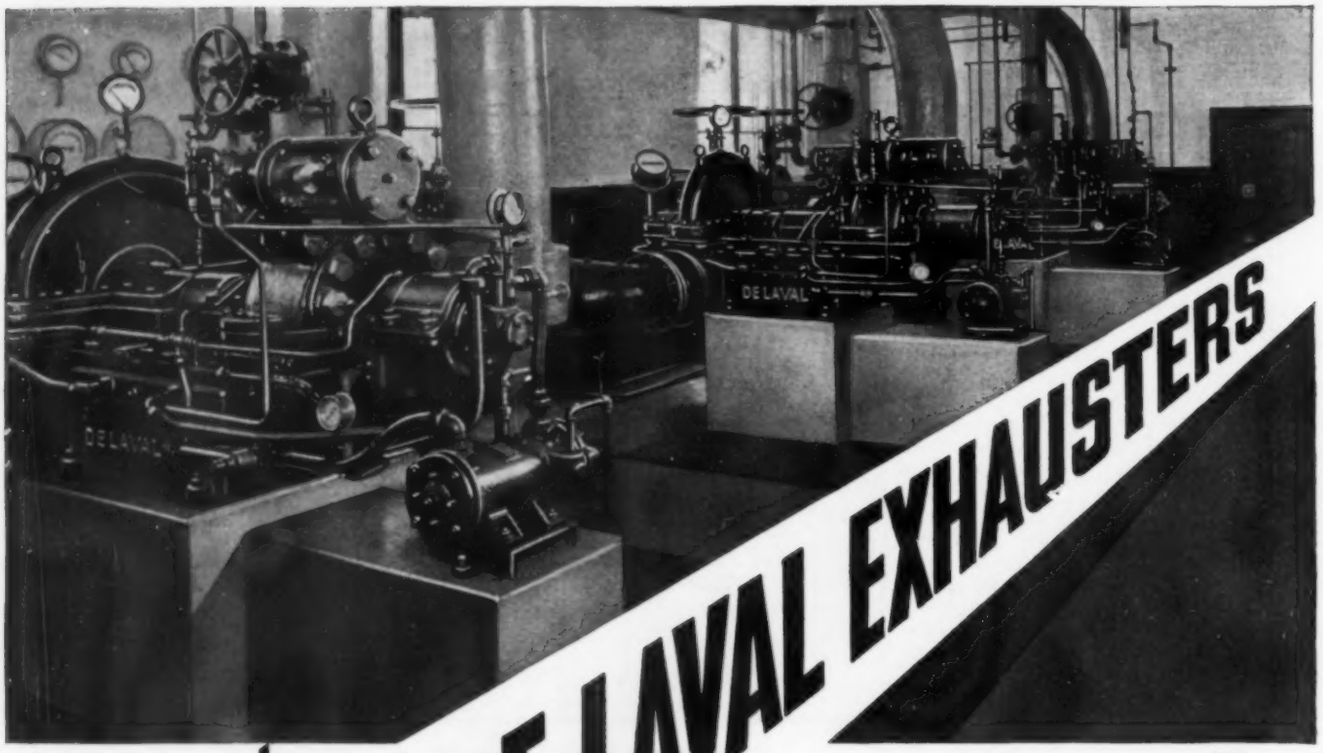
An official statement on British rubber policy was made by the Rubber Controller, and it appears that the establishment of a synthetic rubber industry in the British Isles is not at present intended. During the current year half the quantity of crude rubber will be released for manufacturing purposes of what was distributed in 1941. By instituting an orderly system of release from stocks available supplies are to be spread out until plans have been completed for a satisfactory flow of new material for the industry. The reclaim utilization capacity is being increased so that by the end of this year available supplies will be sufficient to raise the former percentage of reclaim to rubber by nearly five times. It will then reach a percentage which has never been known in any country over any considerable period. In the meantime arrangements have been made to import reclaim from the United States to make maximum use of the material possible at an early date. Many specifications have been revised in the light of research findings by the Technical Sub-Committee of the India Rubber Manufacturers' Association.

The large-scale use of silica gel for refining mineral oils draws attention to the extraction of the material from complex metalliferous wastes which has been achieved by use of a specially constructed filter. Previously the waste was treated by the expensive soda-fusion process in a magnesite-lined hearth which yielded much sodium silicate; ordinary methods of fusion, though cheaper, were ruled out by excessive refractoriness of the wastes and electro-thermal treatment resulted in excessive volatilization losses. Acidification of the "melt" with a view to the reclamation of valuable constituents yielded a voluminous precipitated mass of gelatinous silica which was difficult to handle and to filter. The supernatant liquor is now removed by a special filter which has thus opened up a new source of cheap silica gel while at the same time making the removal method an economic success. The new process is an illustration of the trend which has been strengthened by wartime conditions in British chemical industry of improving the profitability of waste removal by use of former waste materials as products for other processes.

CHEMICALS WANTED FOR URGENT NEEDS OF ARMED FORCES

One of the armed services is seeking chemical manufacturers for the manufacturing of sulphur trioxide solution in chlorosulfonic acid (FS) Spec. 96-31-52; titanium tetrachloride (FM) smoke, and chloracetyl chloride, an ingredient for the manufacturing of chloracetophenone (CN).

Only manufacturers will be considered; packaging concerns will not be considered. Bonafide chemical manufacturers are requested to address their inquiries in writing to Engineer X, Contract Distribution, War Production Board, 122 East 42d Street, New York.



4976

Smooth Running of DE LAVAL EXHAUSTERS pleases plant operators

THE three De Laval turbine driven exhausters here shown are highly praised by the personnel responsible for their operation and maintenance.

They draw gas from holders in which it is received from water gas generators and force the gas through condensers, scrubbers and purifiers, light oil scrubbers and meters to storage holders, where it is mixed with natural gas from pipe lines.

The units are rated to deliver 2280 to 5700 cu. ft. per min. each, with a maximum pressure differential of 60 ins. water column. In order to provide the wide variation in capacities and pressures, the operator can at any time by the simple adjustment of a needle valve, set the variable speed hydraulic governors on the turbines for the speed desired.

The rugged cast iron construction of the blower casing insures good alignment and quiet operation in spite of sudden changes in delivery. Both the turbine casing and blower casing are split horizontally, providing complete accessibility.

The turbine and the blower each has its separate shaft and bearings, the two shafts being connected by a lubricated, all-metal, flexible coupling. This four bearing construction is more rugged and smoother running than is the overhung type of turbine blower unit with only one shaft and two bearings for the two members, as it is less likely to be unstable and to whip when slight unbalancing or wear occurs.

If you use blowers or compressors you will be interested in the wealth of data contained in our new Compressor Catalog F-3819.

DE LAVAL *Steam Turbine Co.*
TRENTON, N. J.

MANUFACTURERS OF TURBINES . . STEAM, HYDRAULIC; PUMPS . . CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, CLOGLESS, SELF-PRIMING; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . WORM, HELICAL and FLEXIBLE COUPLINGS

SMALLER PLANTS IN GERMANY ARE BEING CLOSED IN MOVE TO CONCENTRATE PRODUCTION

Special Correspondence

EDITOR'S NOTE: *Cut off from direct correspondence with all except a few foreign sources in neutral countries, these notes interpret recent developments in continental Europe as reported in publications and official documents received in the United States. These monthly letters, prepared in this country, will be continued only so long as pertinent material of interest to American chemical industry is available for our comment and interpretation.*

CONCENTRATION and rationalization of industries to make the most efficient use of labor, equipment, fuel, power, and transport facilities have entered a new stage in Germany. Clearly a war measure, it represents an about-face from the earlier wartime policy of decentralization. It also runs counter to earlier Nazi economic theory in that it is frankly admitted that in 1942 innumerable medium and small-sized firms will be closed down. Some of them will probably never reopen, for equipment, raw materials, and manpower are being shifted to other localities to more efficient plants. The larger firms will be allowed, for instance, to produce and sell goods using the smaller firm's trademarks and patents, and thus markets may become permanently lost to the older firm.

To alleviate the worst hardships of the complete reorganization now being carried out by the Reichsgruppe Industrie under the authorization of the Economic Ministry, the State Society for Mutual Aid will grant more subsidies to maintain buildings and machinery of plants that are shut down, pay interest on debts, and sometimes even grant subsistence to the owners if they cannot be employed elsewhere. From February 1940, when it was first founded, to May 1941 it had paid out 8,000 million RM in subsidies, and by the end of 1941 the figure had grown to 20,500 million RM. The amounts should grow still faster this year. Cartels, of which there are now 1,700 in the Reich, 300 of them in the iron section, are also being overhauled, as normal competitive economic conditions are inoperative anyway.

Although the German chemical industry is generally thought of as being highly concentrated because of the dominence of I. G. Farben, it is in reality made up of many plants of varying sizes. Smaller chemical plants, in fact, were among the first factories of any kind to be shut down. Before the outbreak of the war, for example, there were 17,055 chemical plants in the old 1938 Reich, employing around 600,000 workers. To be sure, 49.4 percent of the chemical workers were employed in a total of only 86 of these plants. The latter represented some large and modern factories engaged in synthetic or war production and were mostly I. G. plants.

I. G. technicians are reported to be in Turkey along with Siemens electric engineers, supervising installation of a number of new plants in these two fields. In the light of past infiltration tactics of engineers, this is of some significance. Sales offices for the two huge German concerns were established in Turkey in the fall of last year when official trade negotiations were going on. At that time the Turks placed large orders for deliveries to be made by Germany in 1942 in return mainly for Turkish chrome ores which Germany wanted badly. The filling of the Turkish orders is in the hands of three large Reich concerns, the Herman Goering concern furnishing construction materials, Krupp munitions, and Humboldt-Deutsch furnishing motors and army trucks. Before the war, the Reich supplied roughly 50 percent of Turkey's chemical imports, mainly pharmaceuticals and heavy chemicals, fertilizers, dyes, and plastics.

Increased sales in the Balkan markets were expected to counteract losses from overseas trade for German chemical firms. In a recent report, however, the German potash syndicate admits that potash sales in the Balkans have been way below expectations. In fact, compared with 1940, total sales of salts of potash and byproducts by the syndicate declined in 1941. Sales in Denmark, the Netherlands, and Belgium failed to come up to expectations also.

Chemical trade with Scandinavian countries is reported to be faring somewhat better. Whereas only 23 percent of Sweden's total pre-war trade was with Germany, now 70 percent of it is carried on with the Reich, not including occupied countries. In Swedish trade, the balance of payments is normally in Germany's favor, but the situation now is reversed in view of increased Swedish shipments and delayed German deliveries.

Finnish-German trade is also increasing beyond the scope of war materials being supplied. Under a recently concluded trade agreement, Germany is supplying Finland large quantities of chemicals, fertilizers, salts, and coke in return for wood products.

In German-occupied Baltic countries, Esthonia, Latvia, and Lithuania, now renamed "Ostland," a large-scale reorganization of agriculture and industry is reported to be in progress. Since February 1, 1942, a special customs regime has been set up for the new "Ostland." Indicative of plans to utilize this region for food and manufactured products is the fact that chief items exempted from customs duties when imported into these territories are synthetic fertilizers, agricultural insecticides, and solid fuels. A more

extensive exploitation of Esthonian shale oil deposits under German direction is also reported. So far production is supposed to be very small, but the oil needs of the country are not large, and it is hoped thereby to ease some strain on transportation.

In southeastern France, shale deposits are also to be exploited around Narbonne. The project is reported to be under the auspices of the Société Languedocienne de Recherches des Exploitations Mineures, a subsidiary of Potasse et Engrais Chimiques. The shale oil factory already established at Autun is expected to expand its capacity considerably before the end of the year. Regular coal and lignite oil extraction is also being pushed extensively as part of France's new 10 year plan.

The French dye industry is now completely under German I. G. Farben control, following acquisition last fall of the Kuhlmann concern, its chief competitor in France. I. G. holds 51 percent of the stock of "Francolor," the new French dyestuff combine, and three leading French producers share the remaining interest. The new organization has taken over all stocks of dye raw materials and finished products in the country. Part of I. G.'s interest in "Francolor" was supplied in the form of I. G. dye patents turned over to the French company.

Syndicate and cartel arrangements are also being carried out under German direction in Belgium. A considerable loss in Belgian chemical production is expected as a result of the disastrous explosion early in May which is reported to have demolished the plant of the S. A. Produits Chimiques de Tessenderloo in northeast Belgium with a heavy loss of life and great damage to surrounding areas. Before German occupation, this firm was one of the most important Belgian producers of liquid chlorine, hydrochloric acid, chamber sulphuric acid, caustic potash, trisodium phosphate, and various phosphatic and potassic fertilizers. The amount of damage resulting from the blast will probably not be known until after the war, but the violence of the explosion suggests that the plant may have changed its production schedule to direct explosives manufacture.

To provide more scattered targets for air raids, smaller synthetic gasoline plants are being erected in Germany. How much British air raids have damaged the Poelitz plant near Stettin is unknown. The mammoth new synthetic gasoline plant, intended to be the largest in Germany, is costing 200 million RM and is expected to have a capacity of 400,000 metric tons of motor fuels a year when finished. In 1940 Germany reportedly had 25 synthetic fuel plants completed, with several more under construction.

The Fischer-Tropsch plants, from a military standpoint, are supposed to have an advantage over the older Bergius coal hydrogenation plants in being more decentralized. The Fischer-Tropsch

gasoline has at times been reported to have an octane rating of only 40, but through admixture with other substances it apparently is being improved to serve as an aviation fuel. Another serious wartime problem for the synthetic plants of both types is that high pressures and corrosion are hard on steel equipment, and replacements are difficult, if not impossible, to get.

Sewage sludge gas is also being used increasingly as a fuel for trucks in Germany. In 1935, there were 53 German cities recovering 18 million cubic meters of methane from sewage plants. This amount has undoubtedly been greatly increased since then. At that time, a large part of the methane was supplied to city gas systems and was used to run stationary gas engines. Methane as a motor fuel for trucks had to wait until light metal cylinders could be devised. At first, cylinders of 70 liters capacity, which could hold 14 cubic meters of gas at 200 atmospheres pressure were used. It took about 35 cubic meters of gas to drive a 5-ton truck 100 kilometers. Greater efficiency is now announced. The most recent development is that small flasks have been devised to be attached to passenger cars—few of which are still in private operation in the Reich—so that 2 to 4 small flasks are attached to each car. The installations are the same for using either city gas or sewage methane. They require only an advance in the spark and a change in the carburetor. Some cars are now equipped so that while operating, the driver can switch from gasoline to methane and city gas merely by pushing a button on the instrument panel.

Considerable amounts of fodder whey are also utilized when they result as a byproduct in the manufacture of a new casein fiber by the Thueringsche Zellwolle, A. G., Schwarza, which claims to have developed a new fiber process better than the older Snia Viscosa patents of the Italians.

Germany's latest fully synthetic fiber "Perlon" will soon be in large-scale production, according to "Der Vierjahresplan," official engineering and trade journal. "Perlon," it is said, will be used at first only for shoe laces, for toes and heels of socks and stockings, and for other hard-wearing textile purposes.

NEW TRAINING QUARTERS FOR CHEMICAL WARFARE SERVICE

Chemical Warfare Service is establishing a new training center in the Etoah-St. Clair counties region of Alabama with original accommodations planned for 5000 men and provision for expansion. An area comprising 30,000 acres has been acquired for barracks and training facilities. After completing courses at the training center, men will be assigned to various chemical warfare units of the Army. It is anticipated that the first training classes will begin before the end of the summer.

READERS' VIEWS AND COMMENTS

Readers are invited to express their views on articles appearing in Chem. & Met. *or on other subjects of interest to chemical engineers. As far as our space permits such views and comments will be published in these columns. Address your letter to the Editor of* Chem. & Met., *330 West 42 St., New York, N. Y.*

TEXAN PEBBLES

To the Editor of Chem. & Met.

Sir:—We have just read the June issue of your magazine and note the outline of chemical possibilities in various states. This issue included the State of Texas.

You did not mention among the available materials the fact that flint is being produced in the form of grinding pebbles for the process, paint and other industries. Perhaps the writer of the article did not know about it because we have found that a number of engineers, chemists and even geologists were not aware of the fact that genuine amorphous nodular flint, the same kind as formerly imported from France, is available in that state.

Our subsidiary, The R. L. Cawood Company, is mining, processing, and shipping these pebbles in considerable quantities at the present time and so far as we know this is the only source in the Western Hemisphere for material of this type.

Unfortunately, these pebbles do not occur as they do in France, completely washed, well rounded and fully prepared for use by simply picking them up. They must be quarried or mined from a matrix which clings to them and therefore they have to be processed by ball milling, sorted and classified before being ready for use.

If you feel that this matter is of enough interest to justify mention in your paper or if you would like further information we will be glad to supply it.

E. M. Underwood
Vice President of Sales
Patterson Foundry & Machine Co.
East Liverpool, Ohio

CRYSTALLIZATION PROCESSES

To the Editor of Chem. & Met.:

Sir:—The Ross theory as outlined by Mr. Caldwell, in the May issue of *Chem. & Met.* seems to this writer inconclusive as a working concept of a crystallization process. Mr. Caldwell's article treating the Ross hypothesis covers only the limited field of crystallization by cooling and crystallization by evaporation is not considered. I wish to discuss here some of the broader aspects of crystallization in the light of Mr. Caldwell's paper. There is no such strong line of demarkation between cooling and evaporation methods of crystallization as Mr. Caldwell implies. For many chemicals with a fairly steep solubility curve, such as ammonium sulphate, sodium nitrite, sodium nitrate, etc., a cooling or vacuum type or the unit which Mr. Caldwell differentiates as a "salting out" evaporator, can be used with equally good results. The choice depends on local plant conditions.

The supersolubility theory of Miers (*J. Inst. Metals* **37**, 331-350, 1927) forms a fundamental basis for the design of equipment for recovering chemicals in a crystalline state from solutions. This has been the case not only for the limited field of chemicals with a steep or fairly steep solubility curve, where a cooling crystallizer is used, but also for chemicals with a flat or inverted solubility curve, such as sodium chloride and anhydrous sodium sulphate. Equipment such as the Krystal type of crystallizer (*Ind. Eng. Chem.* **32**, 636, 1940) is designed according to Miers' concept of the metastable field of supersaturation, where existing crystals can grow and no crystals are formed. This process has produced outstanding results both for cooling and evaporator crystallization.

Let us examine a few aspects of the Miers based method: (1) Caldwell states that "any crystallizer design involving heat transfer surfaces must be equipped with scrapers or members passing very close to such surfaces to prevent crystal build-up." A cooling unit of the Miers design has no such scraper and units have operated continuously, not only for days, but for weeks with high rate of heat transfer. (2) In handling solutions with an inverted solubility curve, such as sodium sulphate and sodium carbonate monohydrates, a Miers type evaporator-crystallizer operates for long periods without salt deposit on the heating tubes. The results in the above cases are achieved not by any unusual rate of liquor flow over the heating or cooling surfaces, but by keeping the degree of supersaturation as low as the circumstances will permit; that is, the supersaturation remains at all times within the metastable field.

Supersaturation as a factor in the crystallization of sugar has probably been more discussed than the supersaturation of any other chemical. An interesting paper outlining the different zones of super-saturation of sugar solutions is given by Webre (*Intern. Sugar J.*, April 1939, pp. 141-144). The metastable range given for sugar in this paper is very wide, amounting to about 60 parts per 100 parts of water, over and above the saturation at 150 deg. F. Most industrial solutions will have a metastable range only a fraction of this. However, the crystallizer equipment should be so designed that it operates in the metastable field close to the saturation line, allowing for heavy overloads for short periods without upsetting the operation.

To quote from Caldwell's paper: "This writer prefers to classify as a crystallizer any device which produces

crystals essentially by cooling a solution. A device which produces crystals essentially by evaporation of a solution should be classified as an evaporator, or more specifically, as a 'salting out' type evaporator."

It seems to me that the terminology should progress with the technology. Crystals are produced from solutions by other means than cooling, and we should specify the equipment accordingly.

In a so-called "salting out" type evaporator, the unit should be designed for the following main purposes: (1) Sufficient heating surface to transmit sensible heat to the liquor. (2) To release a predetermined quantity of vapor effectively, with a minimum amount of liquor entrainment. (3) To give best possible conditions for crystal growth.

All of these factors are efficiently controlled in a unit designed according to the Miers principle, with each of the above purposes performed in separate part of the unit. The assembled unit should properly be known as an evaporator-crystallizer. Crystallization by evaporation covers a large field of industrial crystallization, and should therefore be classified thereunder.

Regarding Caldwell's reference to Krystal equipment, a few points should be clarified. Caldwell states: "The settled crystals are maintained in a bed through which the recirculation liquor flows." The crystals are not a settled bed; the supersaturated solution is conducted upward through a suspension of crystals and the crystals are kept in suspension by the upward flow. Caldwell mentions further that the Krystal design is used for ammonium sulphate. It is interesting to note that this design is used as well for other sulphates, and chlorates, chlorides, nitrates, nitrites, acetates, carbonates and phosphates.

Regarding purity of large crystals, Mr. Caldwell states: "Large crystals occlude mother liquor with whatever impurities it may contain to a larger extent than do small crystals." The writer's experience is entirely at variance with this statement. It is important to note that if crystals are allowed to grow in a suspension, only the solute will attach itself to the crystal surface. Impurities will be from adhering mother liquor only, except in the comparatively rare case wherein the crystal building may start from colloidal matter in the solution. In this latter case, all the crystals will be affected as well, and probably to a larger extent, than large crystals.

Adhering mother liquor can be washed off fairly completely from crystals grown in a suspension, which means that crystals of high purity can be produced from an impure solution. Under ordinary conditions, the growth of large impure crystals means that the crystals are not individual, but agglomerates, and crevices in the agglomerates permits mother liquor to be occluded. Occluded mother liquor cannot be removed by washing.

As mentioned by Caldwell, the crys-

tal size has a very important bearing upon the cost of centrifuging and drying operations. In this connection, it should be pointed out that an even crystal size is important as well. It is regrettable that few figures are available regarding the efficiency and capacity of the different types of centrifuges when handling crystal slurries of different densities and specific grain sizes. If such figures were available, the chemical manufacturer could specify for the equipment designer the crystal size that would produce the most economical results for overall production costs. The crystallizer could then be designed accordingly.

HANS SVANOE

IN REPLY

To the Editor of Chem. & Met.

Sir:—In reply to your Mr. Svanoe's dismissal of the Ross hypothesis, I plead for comprehension of the import of the original Ross article which appeared in the May 1938 issue of *Pacific Chemical and Metallurgical Industries*. It is compelling logic and replete with microphotographic evidence. His explanation of the formation of a nucleus and its growth appears to be fundamental, regardless of whether the solution is cooled or evaporated or both. It is probably the most inspired contribution since Miers and will open the way to further improvement in the design of equipment to produce crystals.

My article was intended to deal only with equipment which produces crystals as a result of cooling a solution. Such a piece of equipment has been commonly known as a crystallizer, although perhaps the terminology can be changed for the sake of greater descriptive accuracy.

It is freely admitted that borderline cases occur in which the same crystal can be obtained from a solution by either evaporating it or cooling it. But obviously equipment for the evaporation of larger quantities of solution to produce sodium chloride crystals, is totally different physically from equipment used to cool larger quantities of solution to produce for example, potassium chloride crystals. In the former case heat is added, but in the latter equipment which was the subject of my article, heat is removed.

Based on actual results from commercial installations, it can be stated that it is neither necessary nor even desirable for all crystallizations, that the crystals be isolated from one part of the equipment and that the cooling or concentration of the solution be confined to another part. Perhaps a general differentiation can be made between solutions, which exhibit a workable, metastable zone, and those which do not. But, regardless of the presence or absence of metastable zones, the Ross hypothesis gives valuable insight into the mechanism of crystal growth.

H. B. CALDWELL

Swenson Evaporator Co.
New York, N. Y.

Diatoms

IN "PRODUCTION FOR VICTORY"

● Today practically the entire Dicalite output is being utilized in "Production for Victory" — by the process industries and others vitally important in our war program. For example:

CAMOUFLAGE PAINTS, lustreless enamels and other finishes for war use, account for large tonnage of Dicalite extenders and flatting agents. Dicalite gives desirable properties to these products, and conserves by "extending" the supply of essential pigments and resins. Dicalite fillers are also in demand for such products as paper, plastics, rubber, asphalt, and others.

HEAT-SAVING INSULATION—saving millions of B. T. U.'s in boilers, furnaces, kilns and all types of heated equipment. Industries operating at full speed on war production, and our armed forces, are saving fuel, reducing heat waste and increasing efficiency of heated equipment with Dicalite insulated construction.

FILTRATION—Dicalite filteraids give higher flow-rates with brilliant clarity, increases output and improves quality in filtration of all types of liquids. Dicalite filteraids are serving in production of chemicals, food products, oils, lacquer, varnish and other wartime essentials.

● A Dicalite Engineer will be glad to explain how you can most profitably use Dicalite materials in your own operations.

THE DICALITE COMPANY

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JOBBERS AND OFFICES IN PRINCIPAL CITIES OF U.S.A. AND REPRESENTATIVES IN FOREIGN COUNTRIES

PERSONALITIES

Henry J. Masson

Paul W. Bachman

✦ HENRY J. MASSON has been appointed assistant dean of the College of Engineering, New York University, according to an announcement of Dr. Harry Woodburn Chase, chancellor of the University. Dr. Masson has been a member of the instructional staff for the past 25 years. He is now director of the college's graduate and evening divisions, professor of chemical engineering, and chairman of the Department of Chemical Engineering. A native New Yorker, Professor Masson received his undergraduate training at Columbia University which awarded him a chemical engineering degree in 1914. He was awarded the master of arts degree from Columbia in 1916 and at New York University he received the doctor of philosophy degree in 1918. He served as a member of the engineering faculty at Columbia in 1915 and 1917. In the latter year he joined the staff of the New York University as an instructor and was promoted to assistant professor in 1918, associate professor in 1928 and professor in 1932. He was made director of the graduate and evening divisions of the college in 1940.

✦ ROGER ADAMS, chairman of the chemistry department, University of Illinois, Robert C. Disque, president of the Drexel Institute of Technology, Paul E. Klopsteg, president of the Central Scientific Co., and A. H. White of the chemical and metallurgical engineering department of University of Michigan were given the honorary degree doctor of science at the dedication of the Technological Institute at Northwestern University. Among those receiving the honorary degree of doctor of laws were Donald M. Nelson, chairman of the War Production Board, Karl T. Compton, president of the Massachusetts Institute of Technology, Henry T. Heald, president of the Illinois Institute of Technology, and Raymond Walters, president of the University of Cincinnati.

✦ PAUL W. BACHMAN has been appointed assistant research director with Commercial Solvents Corp., Terre Haute, Ind. Dr. Bachman is a graduate of Johns Hopkins from which university he received his doctorate in 1926. He came to his present position from General Chemical Co., where he acted as manager of research and technical supervisor of phosphates.

✦ JAMES H. BOWDEN has left the Virginia Chemical Corp. at Piney River, Va., where he was in charge of phosphate operations and is now with National Cylinder Gas Co., Louisville, Ky., as chemical engineer.

✦ SAMUEL A. WOODRUFF has been named research engineer on the technical staff of the Battelle Memorial Institute. He has been assigned to the division of organic chemistry. Mr. Woodruff is a graduate of the University of Idaho and of the University of Wisconsin. Prior to joining the Battelle staff, he was associated with the North American Rayon Corp., Elizabethton, Tenn.

✦ FRED W. ELLIOTT has been named research engineer on the technical staff of the Battelle Memorial Institute, Columbus, Ohio, and has been assigned to the division of organic chemistry. Mr. Elliott, a graduate of the University of Pittsburgh, was associated with the byproducts division of Jones & Laughlin Steel Corp., Pittsburgh, prior to joining Battelle.

✦ JOHN M. SHARP, director of technical laboratories of the American Bottlers of Carbonated Beverages in Washington, has resigned from that position. Recently he began research work in the Central Technical Laboratory of Armstrong Cork Co., Lancaster, Pa.

✦ GUSTAV EGLOFF, director of research of the Universal Oil Products Co., Chicago, was elected president of the American Institute of Chemists at the annual meeting of the Institute. Dr. Egloff was the recipient in 1940 of the gold medal which is awarded annually by the Institute to the man adjudged to have made significant contributions to chemistry and the welfare of the chemical profession during his career. Donald A. Price, National Oil Products Co., Harrison, N. J., was elected vice president and H. S. Neiman, patent attorney, New York City, was elected secretary.

✦ WILLIAM V. CRUESS of the University of California, has been awarded the Nicholas Appert Medal given by the Chicago Section of the Institute of Food Technologists for outstanding contributions to food technology. The award was voted by a jury of nine representing as many different food fields and geographical areas. Presentation was made by G. V. Hallman, chairman of the Chicago Section, during the annual meeting of the Institute of Food Technologists at Minneapolis.

✦ BERN DIBNER, a founder of Burndy Engineering Co., New York, and for almost 20 years a vice president and general manager, has enlisted in the U. S. Air Corps, despite the fact that the connectors made by Burndy, like most other industrialists today, are now finding their way into war production. Captain Dibner felt that the country's need for active duty service men was the first consideration. Mr. Marvin Lee, chief engineer, has been elected acting general manager by the board of directors to fill the vacancy caused by Captain Dibner's enlistment until his return.

✦ JOHN O. BURTON of International Falls has been appointed as chief of research for Minnesota and Ontario Paper Co. Mr. Burton has served with the company in various capacities for many years. He is a native of Minnesota and prior to 1937 he had been in Washington, D. C., associated with the Naval Research Laboratory and the National Bureau of Standards. While associated with the Bureau of Standards, he received his master of science degree and his doctor of philosophy degree at the University of Maryland.

✦ JOSEPH H. LEUNER, Walter A. Miller and Richard E. Nicholson have recently joined the research and development department of the Bakelite Corp., a unit of Union Carbide & Carbon Corp. They will be located in Bloomfield, N. J. Mr. Leuner is a graduate of Columbia University with a B.S. degree in mechanical engineering. Mr. Miller is a graduate of Stevens Institute of Technology with an M.E. degree, and Mr. Nicholson is a graduate of the chemical engineering class of Pratt Institute.

✦ ROBERT R. WILLIAMS, chemical director of the Bell Telephone Laboratories, New York, and Roger J. Williams, professor of chemistry of the University of Texas, received honorary degrees of doctor of science at the recent commencement of Columbia University. In conferring the degrees, Dr. Nicholas Murray Butler, president of Columbia, cited Dr. Robert Williams for early taking a leading part in research in various fields including submarine cable insulation as well as the structure and synthesis of the antineuritic vitamin and for a long record of accomplishment and distinction in the exceptionally helpful field of scientific inquiry. Dr. Roger Williams was cited for giving nearly 20 years of scientific service to two institutions in the state of Oregon; winning distinction by most important contributions in the field of biochemistry, particularly by research as to vitamins with results which have great importance in medical chemistry.

✦ ROBERT A. WEAVER, president of Ferro Enamel Corp., Cleveland, Ohio, received an honorary degree of doctor of science from Alfred University on June 1. The degree was in recognition of his work as a leader in the porcelain enamel on metal branch of the ceramic industry.

✦ RICHARD F. BERGMANN has been appointed chief engineer of Link-Belt Co., Chicago, Ill. Mr. William W. Sayers, who has served in this capacity since 1925, has been appointed consulting engineer. In this newly created position he will continue to deal with patent matters and be available for consultation. Mr. Bergmann has been assistant to Mr. Sayers from 1933 to 1936 when he resigned to become chief engineer of Rayon Machinery Corp., Cleveland, from which position he now returns to Link-Belt. He is a native of Lockport, Ind., was graduated from Rose Polytechnic Institute at Terre Haute in 1918, and joined the Howe Chain Co. Muskegon, Mich., after a brief service as ensign in the U. S. Navy during World War I.

✦ L. H. CHENOWETH, manager, manufacturers' sales, in the Industrial Products Sales Division of The B. F. Goodrich Co., has been granted a leave of absence to serve on the Rubber Products Division of the W.P.B. While he is on leave duties in the company's Washington office are being handled by I. N. Kimsey, Akron district manager.

✦ ROBERT T. KAIN, sales engineer in the belting department, Industrial Products Sales Division of The B. F. Goodrich Co., has resigned to enter the service of the U. S. Navy, where he has been commissioned lieutenant.

✦ LAURENCE H. CHASE has been named research engineer on the technical staff of the Battelle Memorial Institute,

Columbus, Ohio. He has been assigned to the division of organic chemistry. Mr. Chase, a graduate of Ohio State University, was associated with Carnegie-Illinois Steel Corp., Clairton, Pa., prior to joining the Battelle staff.

✦ ROBERT SEYL, electrochemist and chemical engineer, has been made director of service for the D. W. Haering organization, Chicago. Ilya Stephanoff, Mitchell S. Sniegowski and Isabelle Luan, chemists, have also been added to the Haering laboratory staff. Jack Daggett, chemist, has been transferred from the laboratory to the field engineering department and John J. Meacher, field engineer in Cincinnati, has been promoted to district manager of the new Cincinnati district office of the company.

✦ JOHN G. BEACH has been named research engineer on the technical staff of the Battelle Memorial Institute, Columbus, Ohio, where he has been assigned to the division of electrochemistry. Mr. Beach is a graduate in chemical engineering of the Missouri School of Mines. Prior to joining the Battelle staff, he was associated with the Sherwin-Williams Corp., Detroit, Mich.

✦ THOMAS B. GIBB, JR., PHILIP F. WANGNER, JR., and ROBERT E. MULLER, have been added to the research and development laboratories of the Bakelite Corporation, unit of Union Carbide & Carbon Corp. They will be located at Bloomfield, N. J. Mr. Gibb is a graduate of Wesleyan University with a B.A. degree, Mr. Wangner is a graduate of Tufts College with a B.S. degree; and Mr. Muller is a graduate of Polytechnic Institute of Brooklyn, with degrees of B.Ch.E. and M.Ch.E.

✦ REBECCA SHAPIRO has resigned her position with the New York City Department of Health to become head of the bacteriological department of Foster D. Snell, Inc. Dr. S. S. Epstein, who previously headed up that work, becomes vice president of Kirsch's Beverages, Inc. but will serve in a consulting and advisory capacity.

✦ FOSTER D. SNELL, president of Foster D. Snell, Inc., New York, has been elected chairman of the American Section of the Society of Chemical Industry. The new vice chairman is Dr. Norman A. Shepard; honorary secretary, Mr. Cyril S. Kimball, and honorary treasurer J. W. H. Randall.

✦ HARLAN L. TRUMBULL, for the past 23 years associated with B. F. Goodrich in research capacities, has been selected by the company to head their new research project covering studies of new sources of rubber.

✦ CARL L. FREDERIC, assistant director of research, Dictaphone Corp., Bridgeport, Conn., has been granted leave of absence to join the staff of the Naval

Ordnance Laboratories, Washington, D. C.

✦ MAURICE H. BIGELOW, director of technical service, Plaskon Co., Toledo, Ohio, has been elected a member of the executive committee of the A.S.T.M. Dr. Bigelow received his early education in the Concord, Mass., Schools, following which he obtained his B.S. degree in chemical engineering at Northeastern University, Boston. After graduation from Northeastern, Dr. Bigelow became the head of the science department of an American College in Salonica, Greece. After four years he returned to America and enrolled at the University of Pittsburgh as assistant instructor and in 1933 received a doctorate in chemistry. That year he was offered a fellowship in plastics at Mellon Institute sponsored by Plaskon Co. and after two years Dr. Bigelow was transferred to the main plant of the company in Toledo.

✦ A. GARRELL DEEM, assistant professor of chemical engineering at the University of Illinois has received orders to report for active duty with the chief of Chemical Warfare Service in Washington, D. C.

✦ HOWARD N. EAVENSON, Pittsburgh mining engineer and consultant, has been reelected president of the Bituminous Coal Research, Inc., the research agency of the bituminous coal industry and affiliate of the National Coal Association.

✦ REGINALD S. DEAN, chief of the metallurgical division, Bureau of Mines, has been appointed to the post of assistant director of the Bureau, coincident with a streamlining of the Bureau's administrative organization.

✦ FRANK LAMB, who received his Ph.D. degree from Northwestern University in June, has been called to active duty with the Chemical Warfare Service.

✦ ADRIAN DOCKEN of Northwestern University, has accepted an instructorship at Luther College, Iowa.

✦ GEORGE W. PERKINS has been granted a leave of absence by Merck & Co., Rahway, N. J., to serve as lieutenant colonel in the Chemical Warfare Service. He will be stationed in Washington. His resignation as executive vice president and treasurer of the company was approved by the board of directors and his executive office will remain vacant for the duration of the war. He joined Merck & Co. in July, 1927.

✦ CHARLES C. CONCANNON, Department of Commerce consultant on chemicals, has just been named chief of the Durable Goods and Materials Unit of the Bureau of Foreign and Domestic Commerce. Mr. Concannon succeeds Philip A. Hayward, who has resigned to accept a position in the Navy. In his

new duties, Mr. Concannon will continue his work in the chemical field, while also supervising the Department's activities in a long list of other durable goods materials.

✦ CLYDE D. MARLATT has been elected vice president of the Martin-Dennis Co., Newark, N. J. Mr. Marlatt, formerly assistant to the president, was born in Newark in 1892 and graduated from Princeton in 1913 after which he taught school. In 1916 he joined Martin-Dennis as plant control chemist and subsequently became assistant to the president.

✦ CARL S. MINOR, proprietor of the Minor Laboratories of Chicago and research consultant for Quaker Oats, Commercial Solvents and other chemical companies, was inducted into membership in the professional chemical fraternity, Alpha Chi Sigma, during its seventh biennial conclave in Chicago, June 19-22.

✦ GARDNER H. CHIDESTER, for the past 16 years closely associated with sulphite and semichemical pulping process investigations as a member of the U. S. Forest Products Laboratory's Division of Pulp and Paper, has been appointed chief of that division. Mr. Chidester succeeds the late C. E. Curran as chief of the division.

✦ HERBERT R. QUINA, chemical engineer formerly with the American Agricultural Chemical Co. and more recently with the War Production Board, Washington, has been drafted into the United States armed forces. Mr. Quina, who received his chemical engineering degree from the University of Florida in 1939, was active in the Junior Chemical Engineers of New York and other professional organizations.

✦ HAROLD S. BOOTH has been named chairman of the chemistry department of Western Reserve University, according to Dr. Winfred G. Leutner, president of the University, in the reorganization of the department following action of the trustees. Dr. Frank Hovorka, authority in the field of thermodynamics, becomes the new director of the University's chemical laboratories and a full professor.

✦ H. P. LANKELMA is secretary of the chemical department at Western Reserve University and professor. Dr. Robert E. Burk, professor of chemistry, will be in charge of special projects of the department, and Dr. Oliver J. Grummitt has been promoted to an assistant professor.

✦ WILLIAM KIEFFER of Wooster College, and Dr. Terrell Hill of the University of California have been added to the staff of the chemical department at Western Reserve University.

✦ CHARLES CARPENTER has been selected for the position of general superin-

tendent of Southland Paper Mills at Lufkin, Texas. Dr. Carpenter has been technical director of the mill since it was completed several years ago.

✦ RALPH B. MCKINNEY has been appointed assistant general manager, Paper Makers Chemical Department of the Hercules Powder Co. He has been associated with the Department for the past four and a half years.

✦ W. W. DESCHNER, formerly in charge of the Department of Chemical Engineering at the University of Kansas, is now active head of greatly enlarged Division of Chemical Design, Engineering and Construction of J. F. Pritchard & Co., Kansas City.

✦ CLOUD WAMPLER, executive vice president of Carrier Corp., has been elected president, succeeding the late J. Irvine Lyle. At the same meeting of the Board of Directors, Edward T. Murphy, senior vice president of the Corporation and one of its founders, was elected a member of the Board to succeed Mr. Lyle.

✦ JAMES P. MARGESON, JR., and Franklin Farley were elected vice presidents of International Minerals & Chemical Corp., according to Louis Ware president. The former has been with the corporation for two and one-half years. He has been successively assistant to the president and general manager of the corporation's Magnesium Division. As of July 1 Mr. Margeson has been also appointed general manager of International's Potash Division. Mr. Farley has been general manager of the Phosphate Division since early in 1941.

✦ JOHN T. BURROWS has resigned as vice president of International Minerals & Chemical Corp. and will devote his entire time to the executive direction of the Phosphate Recovery Corp., a subsidiary owned jointly by International, and Minerals Separation North American Corp.

✦ HERMAN K. ECKERT, plant manager of the Nitro, W. Va., plant of the Organic Chemicals Division of Monsanto Chemical Co., has been appointed plant manager of the Texas City plant. Dr. Charles S. Comstock of the production staff of the Merrimac Division at Everett, Mass., has been appointed production superintendent.

✦ S. A. BELL, formerly an instructor at Columbia University, has been added to the staff of Ralph L. Evans Associates, the research division of Evans Chemetics, Inc. Other recent additions are, Clifford H. Bundy, a graduate of Princeton University, Philip Heiberger, a graduate of Cornell and recently connected with Colgate-Palmolive-Peet Co., Dr. John S. McCoy of New York University, Dr. John F. Mulvaney, formerly an instructor at New York University, Miss Florence M. Thein of Mt. St. Vincent College.

✦ A. L. DIEDERICH, JR., formerly of the Barrett Co., has been appointed assistant to the president of J. E. Longergan Co., Philadelphia, manufacturers of safety valves, pressure gages, and allied pressure control equipment.

✦ CHARLES A. MABEY, who has served as physicist for several years in the Briston Co., Waterbury, Conn., is a Harvard graduate and did advanced work in physics at both Harvard and Massachusetts Institute of Technology, has been appointed director of research activities of the company. He also has been associated in research work with International Communications Laboratories of New York, Federal Telegraph Co. of Newark, N. J., and Mathieson Alkali Works.

✦ JOHN R. CALLAHAM, assistant editor of *Chem. & Met.*, has been elected president of the Junior Chemical Engineers of New York, an organization founded in 1937. Before coming to *Chem. & Met.* Mr. Callaham was for a number of years with General Chemical Co. The newly elected vice president is Howard Ten Broeck, Socony Vacuum Oil Co.; Secretary-Treasurer is Albert K. Ackoff, Westvaco Chlorine Products Corp.; and Assistant Secretary-Treasurer is Alvin S. Weiss, Schenley Distillers Corp.

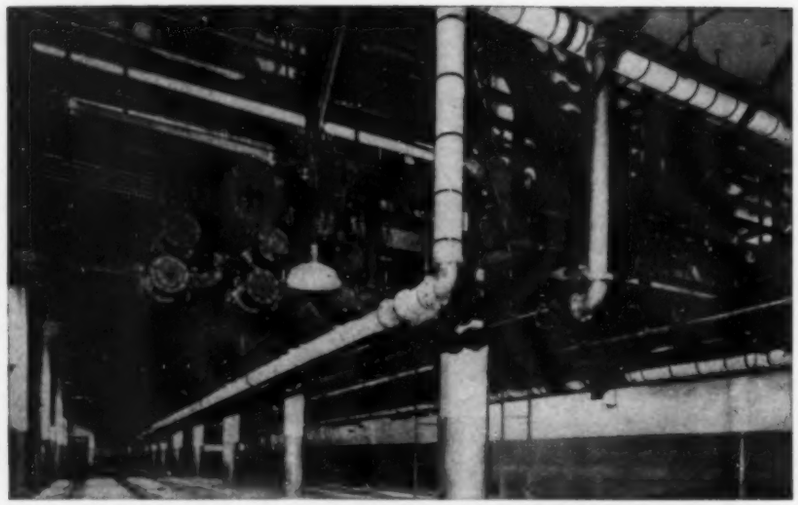
✦ E. W. RITTER on June 15 became assistant to the president of Corning Glass Works, Corning, N. Y. Mr. Ritter recently resigned as vice president in charge of manufacturing and production engineering of the Radio Corporation of America Manufacturing Co., Inc. He will be actively engaged in development, engineering and manufacturing matters relating to war products. Mr. Ritter was born in 1902 in Indiana and graduated from Purdue University in 1925.

✦ JOHN A. MILLER of Price Chemical Co., Louisville, Ky., was reelected president of the National Fertilizer Association at the annual convention in Hot Springs, Va., June 20. H. B. Baylor of the International Minerals & Chemical Corp., Chicago, was renamed vice president, and Charles J. Brand, executive secretary.

✦ C. W. WARNER, vice president of the Maltbie Chemical Co., Newark, N. J., was elected president of the American Pharmaceutical Manufacturers Association at its recent convention. Mr. Warner is a graduate of the chemical engineering department of Lehigh University.

✦ FRANK J. HILL has been elected vice-president of Greene, Tweed & Co. Mr. Hill has been connected with the company since 1915 and has been its sales manager for many years.

✦ THOMAS MIDGLEY, JR., has been elected an honorary member of the National Academy of Sciences.



Ace hard rubber pipe in sizes from 1½ to 8 inches in the above installation. New technique of installation has removed many of previous limitations of hard rubber pipe and fittings.

Ace rubber lined Stacks and Flue Ducts together with Ace rubber covered and lined blowers for carrying off acid fumes.

Ace hard rubber Flexible Pail. 3 gallon size. Will not chip, crack or give trouble in normal service.

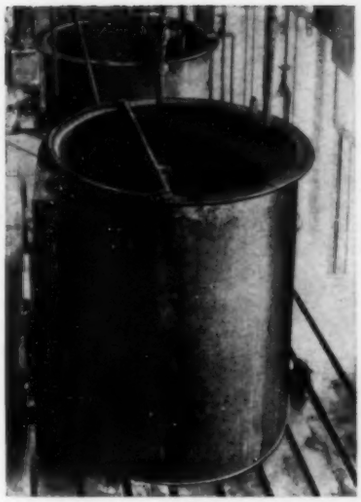
Back

● Ace is Hard Rubber headquarters for rugged and precision parts . . . some smaller than a dime . . . some large as a desk . . . . . all with these advantages:

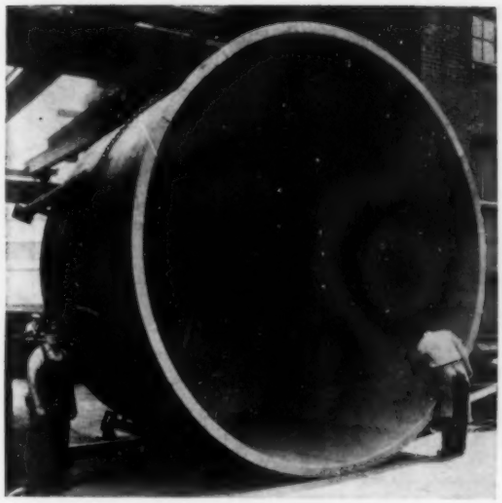
Dependable and Economical Alkali and Acid resistant • Highest electrical and radio insulation properties • Non-Hygroscopic Easily machined, turned, finished.

ACE

Ace hard or soft rubber lined diaphragm valve. Sizes from 1 to 12 inches.



Ace rubber lined bleach and caustic solution tanks.



Ace rubber lined storage tanks made in all sizes for safe storage of expensive chemicals.

of the lines... ACE *prevents corrosion*

★ Tanks, tank cars, pipe lines, valves, pumps, pipe fittings, ACE rubber lined—or lined and covered—offer

. . . . . positive protection against corrosion and contamination
. . . . . rubber compounded to meet specific requirements
. . . . . wide temperature range
. . . . . smooth, non-porous surfaces—easily cleaned

★ "Back of the lines"—SAFE with ACE.

AMERICAN HARD RUBBER COMPANY • 11 MERCER STREET, NEW YORK, N. Y.
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RUBBER PROTECTION *for Defense against Corrosion*

NEWS OF PRODUCTS AND MATERIALS

CLOTTING GLOBULIN

Protection for hemophiliacs against danger of excessive bleeding and effective help for physicians, surgeons and dentists in staunching the flow of blood from small wounds is provided by a new, powerful agent for clotting blood announced recently by Lederle Laboratories, Inc., New York, N. Y. This material, called clotting globulin, is the natural clotting constituent of blood separated in highly concentrated form from clear blood plasma.

RUBBER EXTENDER

Existing supplies of rubber can be extended through the use of Extendex C, a new material offered by Wishnick-Tumpeer, Inc., New York, N. Y. Extendex C can be used to replace from 5 to 20 per cent of rubber hydrocarbon in all types of compounds without sacrifice of physical properties, according to the supplier. Described as a sponge-like material prepared by special patented processes from carefully selected vegetable oils, it is said to be radically different from vulcanized oils in its effects on the properties of rubber. An interesting feature of the material is that it enters into the vulcanization reaction and requires the same amounts of sulphur, accelerator and zinc oxide as does the rubber hydrocarbon. Hence, no change is needed in the quantity of these ingredients when Extendex C is used in existing formulations. It is insoluble in water and common organic solvents and can be used in compounds requiring chemical resistance. In addition to serving as an extender, it also acts as a plasticizer, permitting easier processing of uncured stock on mill, tuber or calendar. It serves also as a dispersing agent for carbon black in heavily loaded compounds. Of particular interest is the claim that it may be used in place of rubber in tires without loss of resistance to abrasion or wear.

BLACKOUT SCREEN

As a result of tests made by the Research products Corp., Madison, Wis., certain general conclusions were drawn regarding the relative merits of blackout and shadow screen materials. Materials used for stopping flying glass from windows, and which will not permit the wave front of the explosion to pass through or around them, will be blown out of position and allow the glass to fly into the room. If materials of this sort are fastened securely enough to prevent their being blown out of position, they must in themselves be exceedingly strong and sturdy or they will be shattered or torn from their fastenings. Materials glued to the glass may prevent the glass from flying in many small pieces, but the whole assembly has little, if any more, ability to withstand the explosion than the glass itself. This results in the entire pane or large sections of it being blown into a room with force enough to cause severe injury. Materials which allow the passage of the explosion wave front without damage to themselves will remain in position. At the same time they will sieve out the broken glass and prevent it from passing through into the room. This is the basis of recommendation for the Research Products Blackout and Shadow Screen. It is light proof for blackout. It permits air to pass, but it stops particles from going through. Within the limits of this series of tests, the effect of the force of the flying glass on shatter screens was less than the effect of the force of the wave front of the explosion.

HIGH-IMPACT PLASTIC

Increasing demands for heavier duty molding compounds to replace other vital materials in war production are said to be the reason for the development of Durez 11934, a new high-impact plastic of the phenolic type. It has a mascerated fabric filler and consequently is not readily preformed. It has an impact strength of 2.0 and a specific gravity of 1.44. It is said to have a very good cure cycle for a material of this type and is available in black or brown colors. Durez 11934, it is stated, will meet the special impact requirements that are required for such applications as small pulley wheels, casters, rollers, and the like.

ALUMINUM CLEANER

After several months of research work, the Nielco Laboratories, 19720 Florence Road, Detroit, were successful in producing an alkali cleaner that not alone reduced the time required to clean a sheet of aluminum to a perfect watershed, but also did this cleaning without building up an oxide coating. The material is known as Alkali Type Nielco Lab. #1167. Aluminum panels were dipped into S.A.E. 50 lubricating oil and allowed to drain for one hour at room temperature. They were then submerged into the cleaning solution at concentrations of 4 to 8 oz. of cleaner per gal. of water at 212 deg. F. The oil was removed completely to give a perfect watershed in 1 min. and 32 sec. at a concentration of 4 oz. per gal. and in 42 sec. at 8 oz. per gal.

WEATHERPROOFING PREFABRICATED METALS AND SHAPES

A method of weatherproofing prefabricated metals and shapes has been introduced by the Coated Products Corp., Verona, Pa. The process, by the utilization of Plastipitch, replaces galvanizing and rolled bituminous applications for weatherproofing and pro-

tecting metals against corrosive atmospheric conditions. It thus releases zinc ordinarily used for galvanizing which is vitally needed for war purposes. The Coated Products process uses Plastipitch, a pitch of improved plastic characteristics. This Plastipitch is used in a simple bonding process to weatherproof completely all types of metals of various sizes, shapes, forms or gages. In the process only prefabricated or preformed metals are used. No further shaping or forming is required after the Plastipitch application is completed. Thus avoiding possible rupture of coating bond and strains in the metal which may result from further mechanical processing.

INSECTICIDE SPRAY

The southern pine is the source of a new insecticide concentrate for contact sprays. The new material is a product of the naval stores department of Hercules Powder Co. It is known as Thanite. The concentrate is effective in low dilution and requires no other toxic agent or activator for fly sprays, according to the company. It is a derivative of the pine which assures a dependable supply.

The Standard Peet-Grady test for insecticides shows that the concentrate in dilutions as low as 1.75 percent produces a B-grade insecticide and in dilutions of 2.5, 3.0 and 5 percent, AA-grade insecticides of plus 19, plus 24 and plus 41 points respectively. Laboratory and field tests established that the material has knockdown and killing properties against flies, bedbugs, mosquitoes, roaches, moths, ants, mites, silver fish, centipedes, and spiders. The cost of insecticide sprays made from the concentrate compares favorably with pyrethrum sprays, the company states, while the cost of Thanite is slightly higher than 20 to 1, concentrate of pyrethrum, a smaller quantity is required to make an AA-grade insecticide.

AIRCRAFT CABIN SEALER

This new compound, product of Presstite Engineering Co., St. Louis, is designed to be used wherever a water and air-tight seal is required, and is particularly suitable for sealing cabins of stratosphere airplanes. It can be applied with a paint brush or spray gun. Tests have proven that the compound withstands temperatures as low as minus 90 F. and as high as 212 F. and still maintains good adhesion to both polished and zinc chromate primed aluminum. Flexibility tests at all temperatures within the above limits show no embrittlement of the compound and no loss of adhesion. The dried film of this sealing compound has no effect on rubber, neoprene or Vinylite resins.

CELLULOSE PRODUCT

The importance of scientific substitutes in filling gaps caused by diversion of vital war materials is reflected in the interest caused by the introduc-

tion of Onco V, a new cellulose product developed by Brown Co., Berlin, N. H. It was originally discovered during research experiments on filler materials for gas masks. First commercial use of Onco V was as an insole fabric to replace latex-impregnated materials commonly used before the rubber restrictions. Among those who see in Onco V a solution to their material problems are manufacturers of luggage or linoleum, gaskets and leather goods who believe that they may have the substitute for leather and cork in this cellulose fabric derived from gas mask research.

PROTECTIVE COATING

Especially manufactured to take care of chemical resistance requirements of metals a new protective coating which withstands weather, hot oil, ultra violet ray, alcohol, inorganic acids, caustic, and high voltages has been announced by David C. Brown Co., Detroit.

The coating is a synthetic resin type which requires baking, known as Resiflex the coating has such properties as heat endurance, acid resistance, unusual arc resistance, high dielectric strength and extreme flexibility. Of low viscosity the coating is waterproof, oil proof, and impervious to mineral acids of any strength, alcohols, and gasolines. Resiflex is furnished in water clear solution only. Application may be made by brushing, dipping, or spraying over any clean and dry surface. Baking time runs from 6 to 30 minutes at 275 deg. to 350 deg. F. depending on size of unit and type of material. Resiflex contains materials which are said to be available to those who have priority certificate of A-3 or better.

PROTECTIVE COATING

To reduce rejects due to rust, surface scratches, shop wearing, grease and dirt, a new protective coating for metal and ceramic surfaces is announced by Ault & Wiborg Corp., Cincinnati, Ohio. Known as Protektoi Stripping Lacquer, the material is unique, in that it is completely transparent to permit visual inspection of the coated parts. The plastic base coating is particularly applicable to highly polished surfaces such as flat sheets, molds, irregular shapes, dies and bearings—offering protection during handling, fabrication, shipping, storage and installation.

In application, the liquid is sprayed, brushed, dipped or roller coated; then air dried to leave a flexible glass-clear coating of from .001 to .0015 in. One gallon, when sprayed to a thickness of one mil, will cover approximately 2,500 sq. ft. of surface. Drying time at 200 deg. F. is six to eight minutes.

To remove the coating, it is necessary merely to lift one edge with the fingernail and peel, or blow off with an air jet. The degree of adhesion to the part protected is controlled to eliminate the possibility of accidental or premature removal. Water and sun-proof,

tie coating is not affected by most greases and oils. There is no deterioration or cracking at temperatures between 0 and 200 deg. F. It is also available in colors, making an ideal temporary identification medium.

After being removed from the article it protects, Protektol Stripping Lacquer may be returned and reduced to liquid form again. This process may be repeated again and again, lowering coating costs to a minimum.

SINGLE-COAT PAINT

A new paint product that primes, seals and finishes on any interior surface in one coat, has been announced by American-Marietta Co., 43 E. Ohio St., Chicago. The product has been formulated for maintenance painting of industrial, institutional and commercial properties, with qualities that permit ease of application with minimum labor.

Designated Valdura Singlekote, it combines the hiding power and economy of water-type paints with washability, durability and performance of oil-type coatings. It may be applied to surfaces previously coated with calcimine or casein paints, providing the old covering is bonded, or tight to the wall. While it easily covers dirt, it is not recommended for use on oily or greasy surfaces. High hiding power permits coverage of dark surfaces with a single coat, and the product is self-leveling. It sets within two hours, dries within 12 hours, and provides a dead-flat finish when viewed at a 90-degree angle.

Interior surfaces that may be covered are plaster, concrete, brick, wallboard, wood, wallpaper and metal. Coverage is up to 750 sq.ft. per gal. Valdura Singlekote is packed in 1-gal. cans, 5-gal. pails, and in drums. It is available only in white, but may be tinted with alkali-resistant colors in oil. Packed in a concentrated form, one gallon of Valdura Singlekote provides five quarts of paint when mixed with one quart of turpentine or mineral spirits.

ANTIOXIDANT

A new antioxidant SA 326 for soap, has been developed by Monsanto Chemical Co., to replace antioxidants now unavailable because of raw material shortages. The new product is an organic amine made from raw materials which are currently available in plentiful quantities and which are not likely to be required in the war effort.

Antioxidants are used in many types of soap, particularly fine grades intended for toilet and bath use, to prevent oxidation and resultant rancidity and discoloration.

The new product is a light gray to white powder that does not affect color, odor or other characteristics. It is used in extremely small quantities varying from 0.04 percent to 0.01 percent on the weight of the soap, the recommended amount varying inversely with the titer of the soap.

Fall Technical Meetings and Programs Now Being Scheduled

CHEM & MET

NEWS OF MEETINGS & CONVENTIONS

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS POSTPONES MEETING

OWING TO THE present war emergency work, the executive committee of the Association of Official Agricultural Chemists, Inc., has recently decided that the regular annual meeting of this association, scheduled for October 27-29, 1942, will not be held. This announcement was released by W. W. Skinner, secretary-treasurer of the organization, which is located in Washington, D. C.

INDUSTRIAL RESEARCH INSTITUTE HOLDS ANNUAL MEETING

THE FOURTH ANNUAL meeting of the Industrial Research Institute was held in Cleveland, Ohio, May 22-23 and over 50 industrial executives and research directors participated in round-table discussions dealing with the relationship of research programs and personnel with war conditions. Guest speakers at the dinner session included Dr. George Crile, eminent Cleveland surgeon and his associates, Otto Glasser and D. P. Quiring. H. S. Benson, United Shoe Machinery Corp., Beverly, Mass., was elected chairman and William R. Hainsworth, Servel, Inc., New York, vice-chairman of the Institute's executive committee for the coming year. Philip W. Pillsbury and Harold K. Work were elected as new members of the committee for three-year periods. Membership in the Institute, an affiliate of the National Research Council, is now composed of 45 industrial concerns maintaining research laboratories.

AMERICAN WELDING SOCIETY MAKES PLANS FOR ANNUAL MEETING

INDICATIVE OF the desire of engineers to assist in the war effort is the statement from the American Welding Society regarding technical papers to be presented at the annual meeting scheduled in Cleveland for October 12-16. Four months prior to the meeting date, acceptances to requests for presentations of papers have been received from 45 individuals representing every field of welding application. The sole motivating force behind this year's meeting is the subject of how welding can assist in winning the war.

Among the technical papers on war-important welding subjects are the following: "Training of Welding Foremen," "Instruction Methods in Welding Developed by U. S. Office of Education," "Suggested Methods Which Will Increase Welding Production and Decrease Welding Costs," and many others. Colonel Glen F. Jenks, president of the Society, will preside at the opening session on Monday. Presentations of medals and prizes will also be featured at the opening session.

AMERICAN CHEMICAL SOCIETY AWARDS MEDALS

THE WILLARD Gibbs Medal, one of the highest honors in American science, was awarded to Thomas Midgley, Jr., vice-president of the Ethyl Corp. at a meeting of the Chicago Section of the American Chemical Society, May 29. The medal was awarded to Dr. Midgley for his discovery of tetraethyl lead as an anti-knock agent in motor fuels, for his development of safe refrigerants, for his contributions to synthetic rubber research, and for his many other scientific achievements. Harry N. Holmes, president of the American Chemical Society, made the presentation.

In recognition for his research in detergents, Lawrence H. Flett was awarded the Jacob F. Schoellkopf Medal at a meeting of the A.C.S. Western New York Section at the University of Buffalo, May 19. Mr. Flett, a chemist with the National Aniline Division of the Allied Chemical & Dye Corp., received the medal from Wilmer H. Koch, chairman. The recipient was cited for his ability in industrial research as exemplified by valuable contributions in the field of dye intermediates, dyes, and detergents, and in further recognition of his encouragement to the spirit of research in industry by precept and example.

The $1,000 prize in pure chemistry has been awarded for 1942 to John L. Oncley, associate in physical chemistry at the Harvard Medical School. Presentation of the award, given annually for outstanding research in pure chemistry by a man or woman less than 36 years old, will take place at the American Chemical Society meeting in Buffalo, N. Y., Sept. 7-11. Dr. Oncley was chosen in recognition of his contribution in the field of protein chemistry. He is cited for his investigations in the dielectric properties of gases, insulating oils, resins, rubber, and proteins, and for the development of radio-frequency bridge methods suitable for precise dielectric constant determinations with proteins.

MANY TECHNICAL MEETINGS NOW BEING SCHEDULED

AMONG THE TECHNICAL association meetings and conventions of interest to chemical engineers and industrial chemists now being planned for the summer and fall months are the following:

American Chemical Society, 104th meeting, Buffalo, N. Y., Sept. 7–11.

National Petroleum Association, annual meeting, Hotel Traymore, Atlantic City, N. J., Sept. 16–18.

Technical Association of the Pulp and Paper Industry, Statler Hotel, Boston, Massachusetts, Sept. 29–30.

National Safety Congress and Exposition, 31st annual meeting, Stevens Hotel, Chicago, Ill., Oct. 5–9.

Electrochemical Society, fall meeting, Hotel Statler, Detroit, Mich., Oct. 7–10.

American Society of Mechanical Engineers, fall meeting, Rochester, N. Y., Oct. 12–14.

American Petroleum Institute, 23rd annual meeting, Stevens Hotel, Chicago, Ill., Nov. 9–13.

American Institute of Chemical Engineers, 35th annual meeting, Nether-

CALENDAR

SEPT. 7-11	**American Chemical Society, 104th meeting, Buffalo, N. Y.**
SEPT. 29-30	**Technical Association of the Pulp and Paper Industry, Statler Hotel, Boston, Mass.**
OCT. 7-10	**The Electrochemical Society, fall meeting, Hotel Statler, Detroit, Mich.**
NOV. 9-13	**American Petroleum Institute, 23rd annual meeting, Stevens Hotel, Chicago, Ill.**
NOV. 16-18	**American Institute of Chemical Engineers, 35th annual meeting, Netherland Plaza, Cincinnati, Ohio.**

land Plaza, Cincinnati, Ohio, Nov. 16–18.

National Chemical Exposition and National Industrial Chemical Conference, Stevens Hotel, Chicago, Ill., Nov. 17–22.

SELECTIONS FROM CONVENTION PAPERS

HEAT TRANSFER AND PRESSURE DROP FOR FLUID IN VISCOUS REGION OF VERTICAL PIPE

NEW DATA are presented on heat transfer and pressure drop for an oil ($\nu^{100°F}$ = 36.6 sq. ft./sec., $\nu^{200°F}$ = 5.70 sq. ft./sec.) and for water moving in streamline flow up a steam-heated vertical pipe. The experiments covered a range of L/D from 126 to 602; of Re from 1.46 to 2700; of Gr from 8×10^4 to 8×10^6; and of Pr from 1.65 to 49.

The heat transfer data are found to be represented within ±20 percent by

$$Nu_m = 1.75 F_1 \sqrt[3]{Gz_m} + 0.0722 F_2 \left(\frac{GrPrD}{L}\right)^{0.84}_w$$

which differs from the theoretical result only in that an exponent of 0.84 replaces the theoretical 0.75. Colburn's 1933 empirical formula is found to predict results 60%—70% higher than the data.

The measured pressure drops are found to be in fair agreement with the theoretical result previously given by Cherry.

The symbols have the following significance:

$Nu_m = \frac{h\,D}{k}$ = Nusselt number based on arithmetic mean temperature difference

$Gz_m = \frac{WC_p}{kL}$ = Graetz number

Gr = Grashof number $\frac{g\,D^3\beta(t_w - t_a)}{\nu^2}$

Pr = Prandtl number, $= c\mu/k$

D = pipe diameter

L = pipe length

F_1, F_2 = functions of Nu_m/Gz_m

ν = kinematic viscosity

R. C. Martinelli, Univ. of California, C. J. Southwell, Standard Oil Co., G. Alves, U. S. Army, Ordnance Div., H. L. Craig, Proctor and Gamble Co., and E. B. Weinberg, N. F. Lansing and L. M. K. Boelter, Univ. of California, before the American Institute of Chemical Engineers, Boston, Mass., May 11–13, 1942.

NITROPARAFFINS AS SOLVENTS IN THE COATING INDUSTRY

NITROPARAFFINS, made by nitrating propane, are unique in their power to dissolve a wide variety of cellulose esters, resins, waxes, gums, and other coating materials. Hence they can be used in many types of specialty coatings.

Nitroparaffins are powerful solvents for most types of synthetic rubber. The application of synthetic rubber solutions as cement and for coating cloth for waterproof garments and tents is of great importance in view of the shortage of natural rubber and the rapidly increasing production of rubber substitutes.

Nitroparaffins are being used in increasing quantities in lacquers based on the newer cellulose esters and on certain synthetic resins. These new coating materials are practically nonflammable and are, for this reason, especially suitable for coating fabrics. Their resistance to sunlight, moisture and chemicals is excellent, but their use has hitherto been restricted by a lack of good solvents. The nitroparaffins now make it possible to utilize these newer coating materials in making lacquers and thus improve the quality of the films that are deposited.

Nitroparaffins are also powerful solvents for the special resins used to line the inside of food and beverage cans. These resins, because of their extreme resistance to attack by the acids normally present in certain foods, should help relieve the tin shortage.

Chloropicrin is a well-known poison gas which can be made from a nitroparaffin. Used during the last World War, this gas has found application in sterilizing soil in which pineapples and various vegetables are grown. Formally made from picric acid, which has important medicinal and explosive uses, it is now being produced from one of the nitroparaffins, thus releasing picric acid for more essential uses.

In many other ways, the nitroparaffins are providing valuable tools both to lacquer manufacturers and to producers of synthetic organic chemicals. Pharmaceuticals are being made from these compounds as well as dyes, chemicals for treating textiles, vulcanizing assistants for rubber, insecticides, and emulsifying agents.

H. L. Wampner and Charles Bogin, Commercial Solvents Corporation, Terre Haute, Ind., before the 103rd meeting of the American Chemical Society, Memphis, Tenn., April 20–24, 1942.

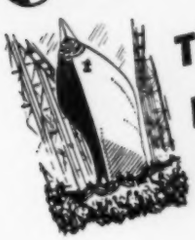
REGIONAL RESEARCH LABORATORIES IN WAR WORK

THE FOUR REGIONAL research laboratories of the U. S. Department of Agriculture established some two years ago are now devoting all their efforts to national defense and war work. Some 741 of the approximately 1,000 people that will ultimately be employed in these laboratories are now at work, and equipment has been or is being installed in all of the 72 individual laboratory units in the Northern Laboratory, 50 of the 72 units in the Southern Laboratory, and in practically all of the units in the other two laboratories.

In anticipation of a shortage of lin-

Control...

THE CRITICAL FACTOR IN SHIP LAUNCHING OR STEEL CASTING



WHETHER the ship is launched by burning away anchor plates or by hydraulic trigger in a pit beneath the hull, it's careful *control* of the operation that sends her sliding smoothly down the ways . . . keeps her from running wild and suffering damage before she has made a single voyage.

Steel castings, too, have a "launching point" . . . melting. Only castings poured from a carefully controlled melt can be top quality.

Lebanon has combed the fields of equipment . . . methods . . . and, yes, of men . . . and chosen those that would make the greatest contributions to control. Lebanon is equipped for both arc and induction melting, according to the character of the steel desired. Optical pyrometer readings (illustrated above) are taken of every melt while it is being poured. A high standard of skill and experience must be met by all melting floor personnel.

Since no casting can be better than the melt from which it is poured, the premium on quality is careful control. Lebanon pays that premium in full. That's why Circle Ⓛ Castings are the choice of users who must be *sure* of quality . . . who cannot run the risks of the "pretty good" . . . such manufacturers as Sperry Gyroscope and Waterbury Tool.

Lebanon metallurgists are studying future applications for alloy and carbon steel castings of controlled quality . . . and are ready to discuss significant developments with forward looking organizations.

LEBANON STEEL FOUNDRY · LEBANON, PENNA.

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON *Stainless and Special Alloy* **STEEL CASTINGS**

ters, work was begun last February to investigate the possibilities of using lint cotton for making smokeless powder. Plant-scale investigations were carried out in cooperation with industry and the Navy Department, and there is every indication that these will be successful. The principal problem involved in using lint cotton in smokeless powder is cutting it quickly and efficiently to suitable lengths for purification and nitration with existing equipment. A new type of cutting machine is being developed for this purpose.

Sandbags are a military necessity and are needed by the millions in warfare; yet, until recently, all sandbags were made from jute or burlap imported from India. Cotton technologists of the laboratories began experiments to see if cotton fabric could be treated to make it satisfactory for sandbag purposes. These experiments were successful and the War Department is now purchasing cotton sandbags according to the specifications developed by this regional laboratory.

Another development that looks promising is the possibility of producing fire hose without the use of rubber and linen. Last September the Civilian Defense Administrator requested an investigation on the possibility of making a fire hose from domestic materials that would be leakproof and strong enough to meet demands for both types of service. The laboratory technologists believe that a pliable plastic-lined hose of proper design can be developed which will be equal and probably superior to the present rubber-lined type. The plastic lining phase of this work is being done by a large manufacturer of cotton fire hose yarn. Other technologists are working in an effort to develop an unlined cotton fire hose to replace hose formerly made of linen and used at comparatively low pressures.

Exhaustive pilot plant research is being conducted on the use of both the tunnel and the cabinet types of dryers for the dehydration of vegetables. A small unit that is a combination of both types has just been put into service. Efforts are being made to prevent off-flavor of the product after it has been re-hydrated. Simultaneous research work is being carried out on various aspects of frozen foods.

Results of laboratory work on developing the Western hemlock bark as a source of tanning material have been satisfactory. The canaigre plant, which grows wild in certain areas in the Southwest, is also promising for the production of tanning materials.

One of the laboratories is now making an investigation on methods of producing "niacin" (nicotinic acid) on an economically commercial basis from nicotine. At the Department's soybean laboratory, a project to extract a protein from soybean curd to be used as a substitute for casein was a success and a commercial plant now in operation is turning out about 6,000,000 lb. of soybean protein a year. However, there is still a shortage because it is estimated that we need about 20,000,000 lb. per year of this new soybean protein. There is enough soybean meal to produce this amount of protein, but the processing machinery is not yet available.

Another laboratory has shown that zein can be used in certain types of paper coatings as well as for other purposes. One of the regional laboratories is conducting work on commercial production of penicillin, a substance produced by the action of a mold, which has been found to be especially efficacious by the English in the treatment of gangrenous infections and burns. Penicillin is at present very difficult to prepare, but if made generally available may be the biggest recent advance in the treatment of infections.

One of the laboratories has just completed and is placing in operation a large pilot plant for the production of motor fuel from agricultural products. This particular pilot plant is large enough to produce 500 gal. of fuel a day and uses the most efficient strains of yeast in fermenting corn and other farm products.

One of the most promising developments of the laboratories is a new rubber extender which can greatly enlarge the amount of commercial rubber that can be produced from natural rubber. This extender can be used on rubber produced from the guayule plant.

Henry G. Knight, Bureau of Agricultural Chemistry and Engineering, U. S. Department of Agriculture, before the 8th Annual Chemurgic Conference, Chicago, Ill., March 25, 1942.

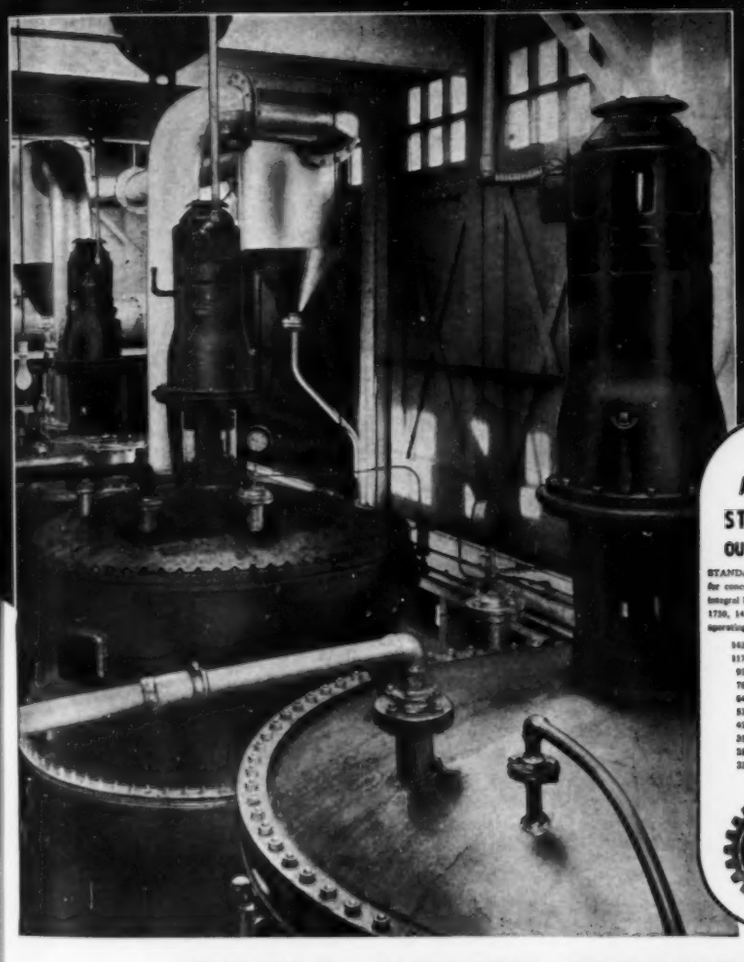
KILN DRYING CORN FOR DISTILLERIES

MUCH OF THE new corn crop used by the distilleries is kiln dried at temperatures of 160-250 deg. F. to reduce the moisture content from 18-22 percent to 12-13 percent. Since plant observations have indicated that kiln drying of corn reduces the alcohol yield, a number of samples of new, high-moisture corn were dried in several types of laboratory kiln dryers under conditions approximating as nearly as possible the procedure used in commercial kiln dryers.

Corn was exposed to temperatures of 160-220 deg. F. for varying time intervals in order to yield the desired final moisture content of 12-13 percent. After this treatment, the corn was cooked, mashed, and fermented under rigidly controlled conditions to determine the alcohol yield.

Results of these tests prove that kiln drying of corn definitely reduces the yield of alcohol. In all cases a 2-3 percent higher yield was obtained from the unheated corn than from any of the kiln-dried portions and with one exception, temperatures of 200 deg. F. or above resulted in an additional 2-3 percent decrease in yield. This decrease in yield between 200 deg. F. and higher temperatures was confirmed by fermentation tests on corn dried experimentally in a commercial dryer at several temperatures. On the basis of

You did tell them how the MOTOREDUCER *design* simplifies the installation *job*



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STANDARD OUTPUT SPEEDS for concentric and parallel shaft integral hp Gearmotors. Based on 1750, 1430 or 1165 rpm motor operating speeds.

1430	190	25
1170	155	20
950	125	16.5
780	100	13.5
640	84	11.0
530	68	9.0
430	56	7.5
350	45	6.0
280	37	5.0
230	30	4.0

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operates all types of valves, etc., safely, economically, from convenient stations.

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All types and sizes of industrial gears. Can be supplied in all materials.

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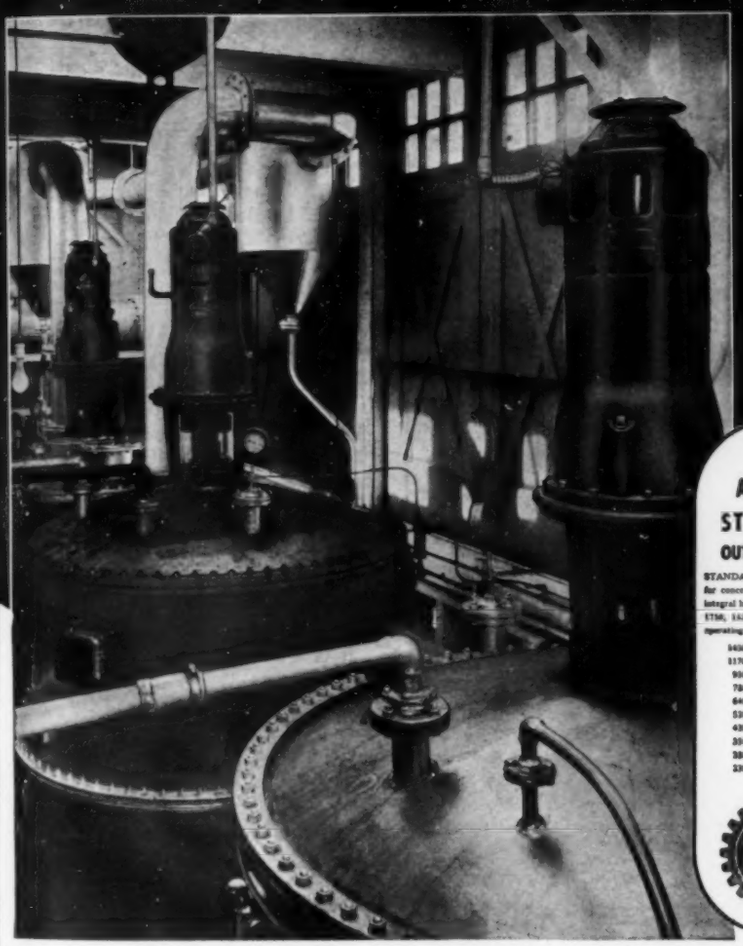

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Philadelphia
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

the present data it is desirable to ferment only naturally dried corn or corn dried at temperatures below 190 deg. F.

S. L. Adams, W. H. Stark, and P. Kolachov, Research and Development Department, Joseph P. Seagram & Sons, Inc., Louisville, Ky. before the 28th annual meeting of the American Association of Cereal Chemists, Chicago, Ill., May 18–21, 1942.

ELECTROLYTIC ZINC OPERATIONS

ELECTROLYTIC ZINC production last year was 223,600 tons, an increase of 20 per cent over the previous year and the highest ever reached by the industry. Of this production, 176,000 tons were from Montana, 39,200 from Idaho and the remaining 8,400 from Illinois.

In Montana, the Anaconda and Great Falls plants of the Anaconda Copper Mining Co. increased their capacity by about 10 percent and recently they were reported to be operating at the record rate of 187,500 tons annually. About 16,800 tons of the 1941 production in Montana was by means of the insoluble lead-silver anode. The Anaconda Company has embarked on a major program to expand its zinc processing facilities whereby the electrolytic zinc plant will be enlarged to increase output 24 percent above present capacity. Construction work on this program will be completed early next Fall.

In Texas, the American Smelting and Refining Co. has begun construction of an electrolytic zinc plant with a capacity of 25,000 tons per annum. This location was selected because of the low cost of fuel in the adjacent natural gas field and its availability for the importation by water of zinc concentrates from foreign countries.

If various increases of production are on schedule, the electrolytic zinc production of this country will be at the rate of 330,500 tons a year by the end of 1942. For 1941, it has been estimated that 15,000 tons of zinc were shipped to manufacturers of French process zinc oxide, while 123,000 tons went to the die casting industry. It is also probable that a high percentage of the total 234,000 tons of metal consumed by the brass industry for 1941 was electrolytic and high grade zinc, since low-leaded metal is required for cartridge brass and manganese bronze.

C. R. Ince, Assistant sales manager, St. Joseph Lead Co., before the American Zinc Institute, Inc., St. Louis, Mo., April 20-21, 1942.

SPIRACTOR LIME-SODA WATER SOFTENER

THIS NEW TYPE of cold lime-soda water softener embodies the revolutionary principle of catalytic precipitation. The chemically treated water passes upward through a bed of catalyst granules contained in a conical device so that the velocity of the water decreases continuously as it rises through the spiractor. The contact of the treated water with the granules of catalyst accelerates the precipitation of the calcium and magnesium compounds, and these precipitates form hard crystalline shells or accretions on

the granules rather than precipitating in the form of fine turbidity which must be settled out of solution.

As a result of the accretions, the granules grow in size and are disposed of periodically by simply drawing them off through a drain valve located at the lower extremity of the cone, fresh catalysts being added at such time to the top of the cone. This permits easy disposal of the precipitated hardness in the form of solid granules rather than in the form of voluminous watery sludge.

Reactions proceed at very high speed so that the total detention period in the spiractor is only 5-10 minutes as compared to one hour even in the most modern types of precipitators.

H. L. Tiger and Martin E. Gilwood, before the Technical Association of the Pulp and Paper Industry, New York, N. Y., February 16–19, 1942.

PLASTICS FROM HYDROLYZED LIGNOCELLULOSE

ALTHOUGH LIGNOCELLULOSE resulting from hydrolysis of part of the cellulose in wood or other plant fibers has the inherent properties of a true thermosetting plastic, it is limited in plasticity and speed of cure to the extent that it is not satisfactory as such for commercial molding operations. By utilizing hydrolyzed lignocellulose as a semi-plastic filler with standard resins, however, it has been found that these disadvantages can be overcome. Major advantages, such as conservation of resin and acceleration of molding cycles for thick molded articles, result.

Hydrolyzed lignocellulose from the continuous process developed by the Northwood Chemical Co. has been combined with standard phenol-formaldehyde and phenol-furfural resins in the proportions of three parts of lignocellulose filler to one part of resin, to yield molding compounds which are acceptable by the molding trade for general-purpose molding. This compares with an average ratio of 1–1.25 parts of filler to one part of resin for general-purpose phenolic molding powder using wood flour as a filler.

Potential reduction in cost of molding powders by the use of a greater proportion of an inexpensive filler is important at any time. During the present emergency an even greater advantage is the extension of limited supplies of resin to give almost twice as many pounds of finished molding compound. Hydrolyzed lignocellulose is being used in molding powders now on the market. The available amount can be expanded rapidly, as the hydrolysis process involved requires no raw material limited by priorities and allocations. Only waste wood and a limited amount of H_2SO_4 catalyst are necessary. It is noteworthy that the simple equipment required is readily fabricated and a large output of product is obtained per ton of metal in equipment.

The product has been produced and modified with the realization that standard procedures in the plastics in-

dustry must be adhered to as closely as possible. As a result, the technique of compounding and molding continuously-hydrolyzed lignocellulose-filled phenolic plastics has been developed so that there is no major deviation from current practice, except for an acceleration of both operations. This result is highly desirable. Particularly important is the reduction in the time required for molding cure, where a decrease by approximately 50 percent greatly increases the productive capacity of the expensive molding machinery and thus reduces the number of units necessary for a given throughput.

R. Katzen, D. F. Othmer, Polytechnic Institute of Brooklyn, and A. O. Reynolds, Northwood Chemical Co., Phelps, Wis., before the American Institute of Chemical Engineers, Boston, Mass., May 11–13, 1942.

CONVERSION OF MAGNESITE TO PERICLASE

A SERIES OF 90 grit samples of magnesite were calcined at temperatures ranging from 900–1,650 deg. C. in a small molybdenum wound tube furnace with a hydrogen atmosphere. The calcination loss was measured for each sample and also the rehydration gain after the sample had been exposed to the atmosphere for about 12 hours. The rehydration gain was found to drop sharply after calcination at 1,200 deg. C. and became practically negligible after 25 minutes calcination at 1,650 deg. C. The petrographic examination indicated qualitatively that the conversion of periclase parallels the drop in rehydration, is almost complete at 1,300 deg. C. and falls to practically zero at 1,650 deg. C. The petrographic report seemed to show that the magnesite had been completely decomposed at 900 deg. C. into an isotropic material having an index of about 1.68. This material apparently absorbs water fairly readily.

B. L. Bailey, technical supervisor, Great Lakes Carbon Corp., Niagara Falls, N. Y. before The Electrochemical Society, Nashville, Tenn., April 15–18, 1942.

SULPHONATED TALL OIL IN MANUFACTURING COATED PAPER

IN COATING-MILL practice, the use of sulphonated tall oil in coating mixes to replace sulphonated castor oil or pine oil has given excellent results in both the ease of coating application and in the quality of the finished paper.

Sulphonated tall oil has, from mill observations, certain advantages over sulphonated castor oil when used in relatively small quantities, such as better brushing and a more desirable surface appearance. Sulphonated tall oil has the added advantage that it can be used in relatively large quantities to obtain other desired results, while sulphonated castor oil and pine oil used in such large quantities would, in many instances, ruin the finished product.

Using relatively large amounts of these oils in casein-oil coating mixes, laboratory tests show definite advan-

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tages in favor of sulphonated tall oil. In these tests, sulphonated tall oil increased the folding and bursting endurance of the test sheets and, in addition, the folding endurance was retained even under extremely dry conditions. Clay-casein coating mixes containing sulphonated tall oil imparted very high tear resistance to the test sheets.

J. Edmond Getty, West Virginia Pulp & Paper Co., Luke, Md., before the Technical Association of the Pulp and Paper Industry, New York, N. Y., February 16–19, 1942.

BEHAVIOR OF THE LEAD-TIN COUPLE IN CARBONATE SOLUTIONS

HIGH CORROSION resistance possessed by tin under most circumstances, combined with its appearance and useful physical properties has led to varied uses for the metal. These have been partly limited by the fact that tin is expensive and hence many applications have been developed in which it has been employed in combination with lead either by coating or by formation of alloys. A detailed knowledge of the corrosion characteristics of the tin-lead couple therefore is of interest and has become especially important at the present time when every effort is being made to conserve tin.

Electrochemical behavior of the lead-tin couple in carbonate solutions was studied under a pH range of 8.4-11.2 to determine corrosion resistance. It was found that in Na_2CO_3 solution with a pH of 11.2 the tin-lead couple is under cathodic control and the anodic elements are tin, but in carbonate solutions with pH values of 10.0 and 9.5, the couple remains under cathodic control and the tin remains anodic. The corroding current becomes increasingly smaller. In solutions with a pH of 8.4 the polarity of the pole has reversed so that lead is anode and the cell is under anodic control. The corroding current is very small. In all of the above cases the corrosion is both chemical and electrochemical.

Additions of Ag, Bi, Cu, and Zn ions to carbonate solutions with a pH of 11.2 have no marked influence on the characteristics of the couple, and additions of Ni and agar-agar reduce the current in the cell without altering the potential.

Potassium chromate and sodium silicate reduce both the potential and the current considerably. However, they also reverse the polarity of the cell so that lead becomes anode.

Gerhard Derge, Harold Markus and Arthur Grobe, Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa. before the American Institute of Mining and Metallurgical Engineers, New York, N. Y., February 13, 1942.

PREPARATION AND USES OF LEVULINIC ACID

LEVULINIC ACID can be prepared simply by heating a hexose sugar in mineral acid solution. Cornstarch has been found to be an ideal raw material from the standpoint of availability, economy, purity and yield of product. Conversion of starch to levulinic acid proceeds through several steps which involve hydrolysis of starch to dextrose, decomposition of dextrose to intermediates, including ω-hydroxymethylfurfural, and degradation of the latter to levulinic acid.

Only recently has levulinic acid become available in commercial quantities for extensive experimentation. A highly reactive compound, it is a versatile starting material for organic syntheses. Esters and other derivatives show promise in the industrial field. Calcium levulinate has become an important pharmaceutical chemical.

W. W. Moyer, A. E. Staley Mfg. Co., Decatur, Ill., before the American Chemical Society, Memphis, Tenn., April 20-24, 1942.

CONVERSION OF DISTILLERY MASH FOR CONTINUOUS PROCESS

CONVERSION OF grain starch to sugar by malt amylase was studied to develop a conversion process suitable for continuous operation. At the time of the investigation, distillery procedures employed a conversion time of 20-60 minutes, dependant upon the type of cooking.

Early tests indicated that conversion of 70-85 percent of the starch to sugar could be obtained with 1-15 minute conversion at 63 deg. C. It was previously believed that at least 80 percent conversion was necessary for good fermentations, since conversion tests of mashes below this figure indicated poor conversion. However, test fermentation of spirit mashes converted for one minute gave yields equal to or better than those converted by the usual procedure. Residual sugar content of fermented mash increased proportionately with length of conversion time.

Test fermentations were made to determine the effect of conversion pH and stillage, using fast conversion. No difference in yield was obtained between mashes converted for one minute at pH values of 5.4 to 5.5 and 5.8 to 5.9 where stillage was used. Water mashes converted for one minute at 5.8 to 5.9 gave slightly higher yields than those converted at 5.4 to 5.5. Stillage improved the fermentation of mashes converted for one minute. As a result of this investigation, a continuous conversion process has been developed.

F. H. Gallagher, H. R. Bilfor, W. H. Stark, and P. J. Kolachov, Research and Development Department, Joseph E. Seagram & Sons, Inc., Louisville, Ky., before the American Chemical Society, Memphis, Tenn., April 20–24, 1942.

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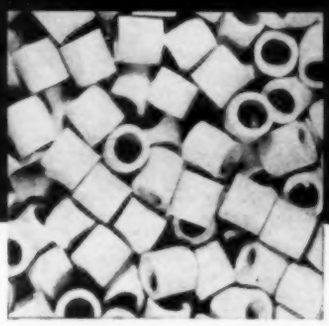
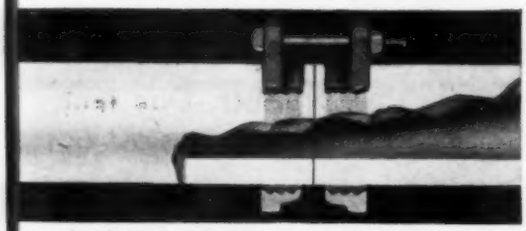


Raschig rings of Lapp Porcelain facilitate gas absorption processes by prohibiting contamination, and by standing up without crumbling under longest, most severe duty.



Lapp Chemical Porcelain Pipe is available in all standard sizes up to 8" inside diameter. Its ground ends permit installation with thin hard gaskets, eliminating at its source the chief cause of trouble in most corrosion-free pipe.

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To installations for industrial-scale processing of corrosive liquids, Lapp Chemical Porcelain offers notable advantages:

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CHEMICAL PURITY. As a material of construction, Lapp Porcelain brings the purity always associated with laboratory porcelain to industrial processing. Completely iron-free, it is a dense, thoroughly-vitrified non-porous body, smooth and corrosion-free.

STRENGTH AND LONG LIFE. The fragility which the word "porcelain" sometimes suggests is not a property of Lapp Porcelain. This material is remarkably rugged, able to withstand mechanical shock of surprising intensity. As a major contributing factor in its purity and long life both, is its complete non-porosity—it does not absorb the liquids exposed to it. The only exposure is on the surface... the body cannot be weakened by the capillary forces of penetrating liquids.

A phone call or letter will bring a quick answer as to how Lapp Porcelain can help you meet your processing problem, quickly and with top production performance. Lapp Insulator Co., Inc., Chemical Porcelain Division, LeRoy, N. Y.

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(Where higher pressures are desired, use Powell All Steel Valves).

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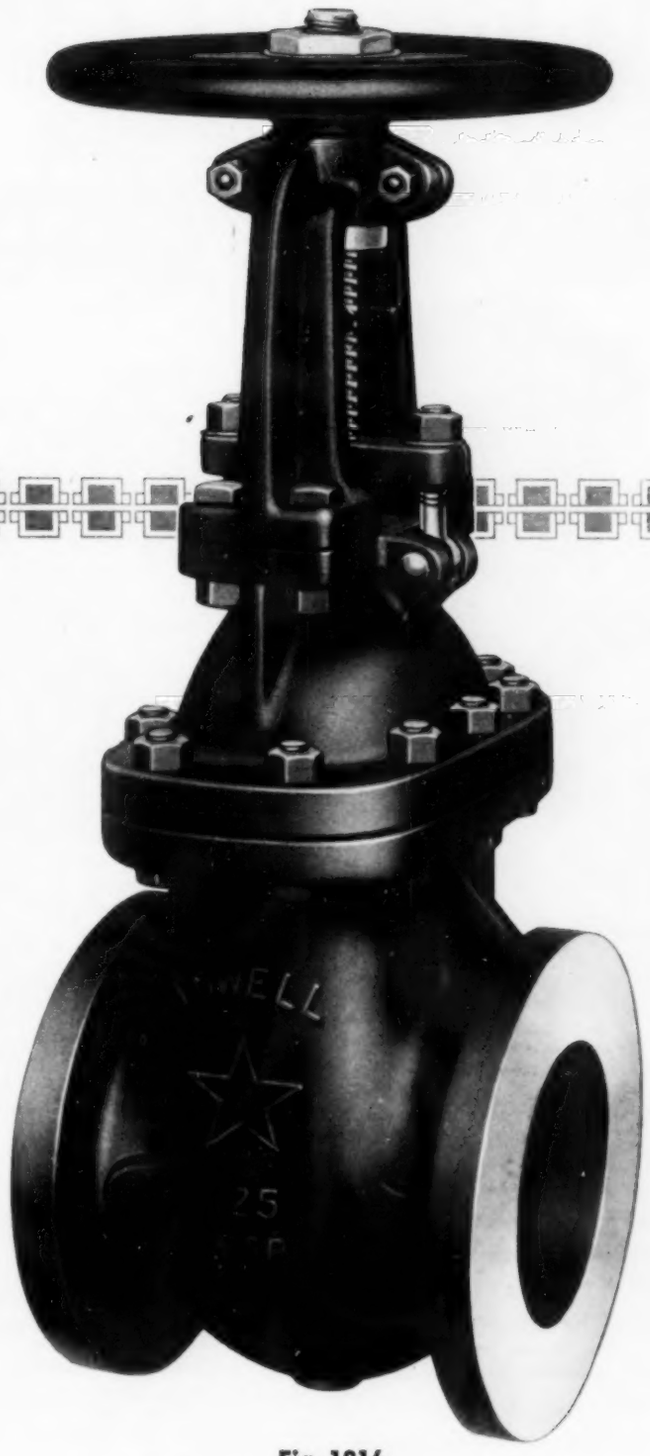


Fig. 1816
All Iron Flanged End Gate Valve
Sizes 2" to 30"

VALVES

SELECTIONS FROM FOREIGN LITERATURE

ZINC OXIDE IN PAINTS

EXPOSURE tests on tinplate and yellow pine panels have confirmed the validity of high durability claims for acicular zinc oxide in boiled oil paints. The tests show, however, that crystal size is a factor and the claim of superiority cannot be extended to very small particles although it holds for comparatively large acicular crystals. The reason for greater durability is that failure by checking is eliminated and the film holds until long cracks begin to form. Zinc oxide with large irregular particles (some of them being acicular) is often called acicular, but it is inferior to the true acicular oxide in paint film durability. On the other hand it is not subject to the checking which usually appears in paints made with fine amorphous zinc oxide.

Acicular zinc oxide loses its superiority to a large extent in stand oil enamels, not because its quality is lower so much as because the other forms (amorphous and irregular) behave better. Thus, there was no cracking after 30 months of exposure in paints made with coarse acicular, coarse irregular and fine amorphous zinc oxides. Fine amorphous oxide can be greatly improved in resistance to checking; thus, some improvement was gained by adding 15 percent of acicular asbestine and a still better effect was obtained with 15 percent of a flaky asbestine.

Digest from "Zinc Oxide as a Paint Pigment," by A. Robertson, *Journal of the Oil and Colour Chemists' Association* 25, 53-61, 1942. (Published in England.)

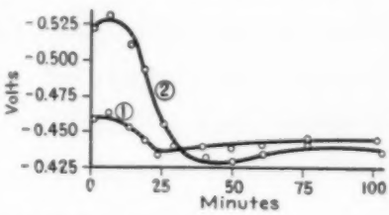
ALL-FLOTATION PROCESS FOR GALENA

AN ALL-FLOTATION process, developed for recovery of galena and marmatite from ores mined at Broken Hill (Australia), has been operating successfully since 1939. As compared with combined gravity-flotation recovery the new plant effects savings of at least 45 percent in capital outlay, over 60 percent in surface area, 35 percent in number of workmen for operation and 3 kwh. in power consumption per ton of crude ore. For a 2,500 ton plant recovery by combined gravity and flotation would require at least five duplex jigs and 45 concentrating tables, with the requisite dewatering classifiers, pumps and other equipment. Collection and thickening of the slime lead flotation feed would require at least 4,500 sq. ft. of thickener area along with launders, piping and pumps. The same lead recovery is effected in the all-flotation plant with 12 Denver Sub. A (No. 21) flotation cells. The ore from Broken Hill is particularly adapted to all-flotation recovery since it does not require fine grinding nor the use of depressants and alkalinity control reagents. Selective flotation of galena from marmatite relies mainly on proper proportioning and control of ethyl xanthate, but depends on proper closed circuit grinding of the ore. Fine grinding is not necessary.

Digest from "Development of the All-Flotation Process at Zinc Corporation Limited, Broken Hill," by M. A. Mackay, *Proceedings of the Australasian Institute of Mining and Metallurgy*, No. 123, 95-122, 1941. (Published in Australia.)

ELECTRODE POTENTIALS OF TIN

THE ELECTRODE potential of tin in electrolyte solutions is an important property in relation to corrosion in contact with aqueous liquids. Tests have been made in solutions of KCl, NaCl, NH_4Cl, HCl, $BaCl_2$, KBr, KI, KNO_3, Na_2SO_4 and NaOH at various concentrations. The results show the controlling factors to be polarity in the anode zone, specific action of anions on the oxide film and complex ion formation. In two of the electrolyte solutions (KNO_3 and NaOH) tin behaved like a metal:metal oxide electrode. The influence of an oxide film on the potential is illustrated by the two curves. Tin for these tests was



cut from commercial sheet tin. Curve 1 represents the potential in 0.5*N* KCl solution after coating the metal with oxide by heating the test piece 8 hr. at 195-200 deg. C. Curve 2 represents the potential of untreated tin in the same solution.

Digest from "Irreversible Electrode Potentials of Tin," by A. Ya. Shatalov, *Zhurnal Fizicheskoi Khimii* 15, 401-9, 1941. (Published in Russia.)

DEHYDRATED CASTOR OIL

SINCE THE commercial production of dehydrated castor oil (DHC) for paints began about seven years ago, many improvements have been introduced. Its original uses in baking varnishes and for oiling textiles have been greatly extended. Although DHC is still reacted with phenolic resins to produce special finishes it is capable of various uses which do not involve this sacrifice of its remarkable non-yellowing property. Whereas tung oil is not gas-proof, it is not difficult to produce gas-proof DHC films.

The principal commercial grades of DHC have the viscosities 7, 46, 120 and 180 poises. The 46 poise oil is especially well adapted to pigmentation; it yields fast-drying, non-tacky and high gloss films. The new titanium dioxide pigments extended with barium carbonate give exceptional results, forming paints with excellent performance and brushing properties. Thus two outstanding non-yellowing paint materials are brought together

in one paint. For baking enamels, the rate of polymerization or drying is speeded up about as much by 3.5 percent of melamine resin as by 0.5 percent of a lead drier.

Digest from "Dehydrated Castor Oil: Fact and Fiction," by C. W. A. Mundy, *Oil and Colour Trades Journal* **101**, 305-6, 1942. (Published in England.)

GAS VOLUMES IN FURNACES

PROBLEMS of gas flow, combustion and waste gas disposal are critical in modern furnace operation. Effluent gases are often toxic and corrosive, requiring treatment before they can be vented to the atmosphere. For measuring the volume of effluent gas, a pitot static tube does not increase the resistance to flow as an orifice meter does. Both instruments lose their accuracy in continued use, especially in dusty or corrosive gases, and therefore require some care in maintenance. Anemometers may be used at low gas velocities if the gas is neither dusty nor corrosive. An automatic device for determining dust content of the gas utilizes a wrought iron sampling pipe, a felt or asbestos filter bag and a sampling thimble. The dust determination is essential as a guide to efficient operation. Chemical analysis of the dust reveals whether or not any recoverable value is being lost in the flue dust. By combining the velocity and volume measurements of the effluent gas with calorimetric studies and gas analysis, losses can be detected and accurately estimated. By preventing the observed losses furnace efficiency is increased. Even a fraction of a percent is significant in furnace efficiency.

Digest from "Gas Volumes in Modern Furnaces: Determinations Have Many Practical Applications," by Howard M. Brownrigg, *Canadian Mining Journal* **63**, 225-31, 1942. (Published in Canada.)

SALT AND WAR CHEMICALS

EXPLOITATION of natural salt deposits benefits the nation by promoting sound development of a domestic chemical industry. For immediate needs production of many military chemicals is speeded up since most war gases contain chlorine and many military products depend on chlorine or alkali in their manufacture. For the long term view a stable position is established against the peacetime return of competition in international trade. Production of alkali and chlorine from local sources (salt mines or brine wells) is particularly beneficial to private industry now that military needs have multiplied the demand. Particular attention should be given to calcium chloride because its merit as a decontaminant would become vitally important in case of gas warfare. As a generalized approximation half a kilogram of calcium chloride will clear a square meter of contaminated ground; thus the requirement is about 243 metric tons of chlorine per square kilometer. Another important use for chlorine compounds is in laying smoke screens to conceal military or naval maneuvers or

targets. Caustic soda also has numerous uses related to munitions of war. Special emphasis may be placed on its vital part in making gas mask filters for protection of the civilian population as well as the armed forces.

Digest from "Importance of Caustic Soda Manufacture for National Defense," by Carlos V. Guilhon. *Revista de quimica industrial* 11,, No. 119, 12-15. 1942. (Published in Brazil.)

CHROME YELLOW

DIRECT precipitation methods for making chrome yellow reached a high state of empirical skill in controlling tint, but there are certain inherent disadvantages in chemical precipitation. One is that the spent reagents contain valuable components which must either be wasted or subjected to more or less expensive recovery processes. Modern electrolytic production of chrome yellow can be carried on as a continuous cycle in which no reagent is wasted. Electrolytic lead for the anode must be at least 99.9 percent pure. Tint of the product is controlled in part by varying the sodium acetate concentration in the anolyte (sometimes as low as 1.5 percent). Bath voltage may be as low as 1.4 v. in some cases, which means low resistance losses. Amperage also varies according to requirements but is generally two or more amp., per sq. ft. of anode. Lead dissolved from the anode passes through a fine Irish linen diaphragm into the catholyte. The resulting lead chromate precipitate is kept in suspension by the motion of the liquid. Continuous filtration in rotary vacuum filters and continuous recycling of the sodium acetate are important factors in the high chemical and economic efficiency of the process.

Digest from "Electrolytic Chrome Yellow" by A. G. Arend. *Paint Manufacture* 7, No. 1, 7, 1941. (Published in England.)

METAL VALENCE FORCES

THE FORCES which bind metal atoms together have much to do with the strength and other physical properties of pure metals and their alloys. In some cases the crystal structure of a metal or alloy reveals whether the forces are solely metallic or are associated with heteropolar or homopolar valences. Superimposed heteropolar and metallic valence bonds are particularly characteristic of the nickel-arsenic type of alloy. There is a transition from there to the gamma brass type of copper-indium, copper-gallium and copper-aluminum alloys which suggests a similar association of forces, but with heteropolar bonds subordinate to metallic bonds. The respective positions of alloy components in the periodic system also give some evidence concerning the nature of the valence bonds. Thus, in agreement with the predicted heteropolar forces, the alloy components are all from 2 to 5 places above the inert gases in nickel-arsenic type alloys and from 3 to 6 places above the inert gases in gamma brass type alloys. On the other hand, there are 3 alloy types in which distinctions

cannot be drawn on the basis of coordination number, structural relations or ratio of like to unlike interatomic forces, and in these alloys the distribution of components in the periodic system is entirely at random. These three are the $MgCu_2$, $MgZn_2$, and $MgNi_2$ types.

Digest from "Crystal Structure and Valence Forces in Metals," by F. Laves, *Chemiker-Zeitung* 65, 184-5, 1941. (Published in Germany.)

ELECTROLYTIC OZONE

Low yields of ozone in electrolytic production as compared with the electric discharge method may be attributed to neglect of fundamentals, not to inherent unsuitability of the electrolytic method. Yields obtained by the empirical procedure are improved by every new observation in research on the actual mechanism of the process. One of the foremost factors overlooked in the empirical trials was the influence of oxygen overvoltage at the anode on ozone formation. Unlike hydrogen overvoltage at the cathode, oxygen overvoltage is directly concerned in the conversion of oxygen to ozone. An oxygen atom liberated at the anode has two possibilities; it may combine with another oxygen atom to form molecular oxygen, or with an oxygen molecule to form ozone. By taking advantage of this and other factors the yield of electrolytic ozone has been increased from 7.2 to 12 g. per kwh. Platinized platinum anodes gives a lower voltage but a much slower drop in e.m.f. than polished platinum anodes.

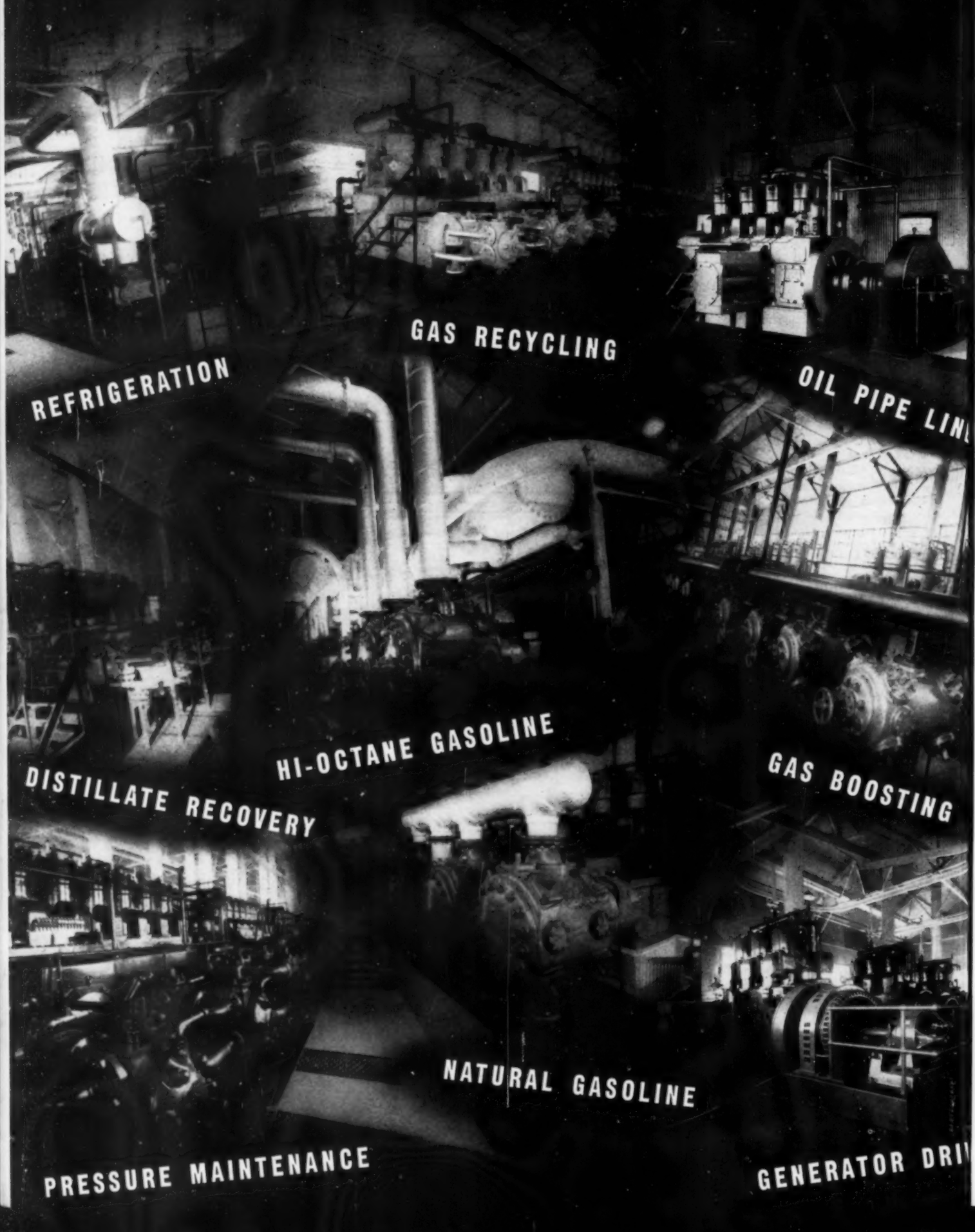
Digest from "Electrolytic Ozone Production and Anodic Overvoltage," by E. Briner and A. Yalda, *Helvetica Chimica Acta* 24, 1328-45, 1941. (Published in Switzerland.)

SWELLING OF WOOD

The swelling behavior of wood is essentially that of a gel system and the pressure effects are correspondingly different from the pressure responses of solutions. A gel can resist shear stresses whereas a solution at rest can resist only hydrostatic pressure. The gel, on the other hand, is subject to plastic deformation. If swelling of a gel is opposed by influences which cause shear stresses its plasticity will induce hysteresis in the isotherm obtained by plotting moisture content against vapor pressure. Swelling pressure can be accurately calculated for simple gels but the structural characteristics of wood complicate the calculation. Thus, longitudinal swelling in wood is negligibly small so that all the swelling is transverse. Assuming the transverse properties to be isotropic the equations for 2-dimensional isotropic gels are applicable to the swelling of wood. Based on these considerations the swelling pressures of wood are calculated for progressively increasing moisture content. Sorption hysteresis is an influential factor in the swelling of wood.

Digest from "Wood Water Relationships. VII. Swelling Pressure and Sorption Hysteresis in Gels," Wilfred W. Barkas, *Transactions of the Faraday Society* 38, 194-208, 1942. (Published in England.)

CLARK "ANGLES" SP



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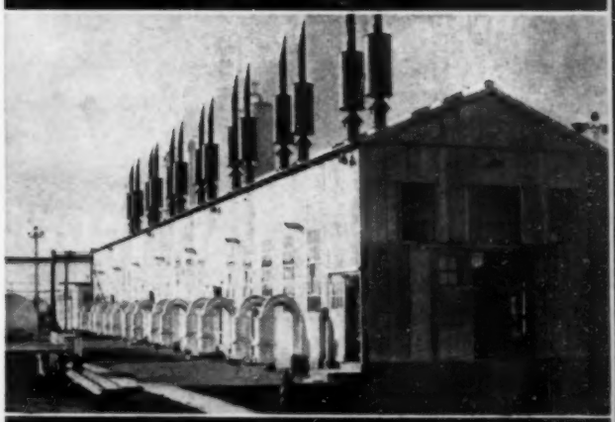
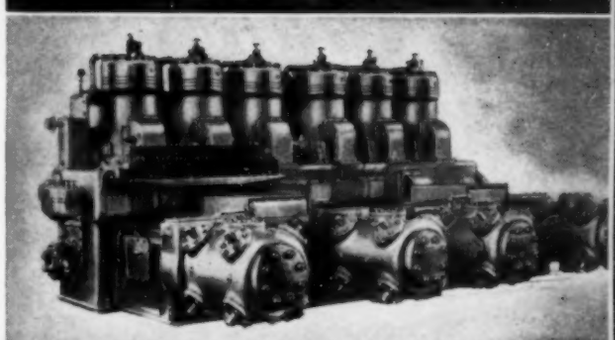
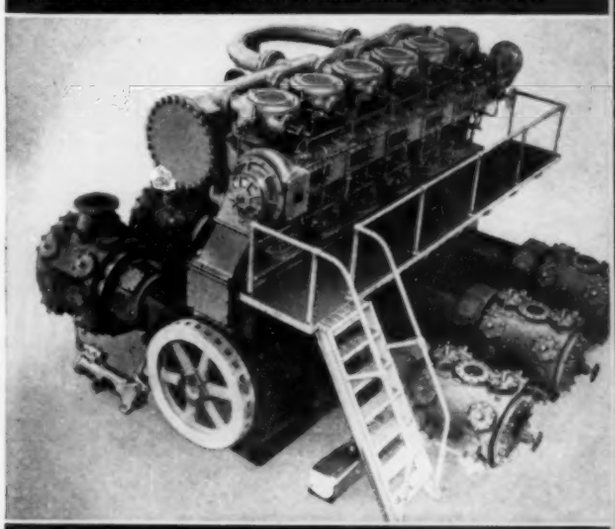


This building, only 24 feet wide, houses 7 600 H. P. CLARK "Angle" Compressors, totaling 4,200 H. P.



CLARK 6-Cyl. "Angle" Compressor, gas or Diesel driven. Sizes from 2 to 8 cylinders: Gas-Driven 200 to 1000 H. P.; Diesel Driven, 175 to 700 H. P.



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SAVE THE SURFACE

PROTECTIVE AND DECORATIVE COATINGS. Vol. II. Edited by *Joseph J. Matiello.* Published by John Wiley & Sons, New York, N. Y. 658 pages. Price $6.

SECOND in the series on protective and decorative coatings, this volume is a survey of the raw materials-pigments, metallic powders and metallic soaps. It covers the chemical compositions, processes, characteristics, methods of identification, etc. The authors have prepared the material for the purpose of serving not only as a text for recent graduates entering industries in which pigments and metallic soaps are used but also as a convenient and complete reference source for those already engaged or interested in these or related industries.

As was the case with the first volume (see *Chem. & Met.*, Jan. 1942, p. 163) the editor has called upon industrial authorities in the various phases of the subject to prepare the material on each. This practice has given greater authenticity to the statements.

Among the subjects discussed are: the complex chemistry of the formation of the synthetic organic pigments and the latest developments in microscopic methods of identifying azo pigments. Colored pigments come in for considerable attention, as do white hiding pigments, white extender pigments, black pigments, metallic powders and soaps.

APPLIED ELECTRONICS

THE ELECTRON MICROSCOPE. By *E. F. Burton* and *W. H. Kohl.* Published by Reinhold Publishing Corp., New York, N. Y. 233 pages. Price $3.85.

Reviewed by *Emy Henning Nachod*

A HAPPY union indeed, formed by Dr. Burton of the Department of Physics of the University of Toronto and by Dr. Kohl, of the Rogers Radio Tubes Ltd., produced this very readable little book. The university scholar and the industrial research man give both points of view and enable the reader without any prior knowledge of the subject to understand this very elegant tool of research which recently has been added to scientific instrumentation.

As stated before, the reader need not have more than a faint recollection of high school physics in order to understand this book. He is carefully nursed along, aided by numerous sketches, 110 illustrative figures, and several excellent photographs taken with the electron microscope. Most of the sketches are popularized. So, the reader is made to understand the laws of optics, aided by pictures of giraffes, cats, mice, squirrels, ducks, and so forth. The chapters deal with an explanation of vision, light microscopes, the various theories dealing with the nature of light, the theory and movements of electrons, which lead to the explanation of electronic optics, i.e., the electronic mirrors and lenses. Then follows a brief history of the electron microscope and the explanation of the electrostatic and magnetic types of instruments. Finally, the reader is shown, aided by excellent illustrations, what the electron microscope can accomplish. A general bibliography concludes the text.

The authors can be complimented for their book, which in simple language gives account of so intricate an instrument. Without doubt it will fill a gap in many libraries and it will encourage use and application of this brilliant new scientific tool.

HELPS FOR FOREMEN

FOREMANSHIP FUNDAMENTALS. By *A. L. Kress.* Published by McGraw-Hill Book Co., New York, N. Y. 276 pages. Price $2.50.

THERE are many concrete ideas and suggestions in this book written for foremen to help them do the most effective job now when every minute counts. Its first seven chapters, constituting part I, discuss the personnel problems of foremen including new employee training, grievances, wages, safety, and collective bargaining. Part II covers such foremen's production problems as production schedule planning, quality control, cost reduction and other important considerations.

PHYSICAL CHEMISTRY

AN INTRODUCTION TO ELECTROCHEMISTRY. By *Samuel Glasstone.* Published by D. Van Nostrand Company, Inc., New York, N. Y. 557 pages. Price $5.

Reviewed by *C. L. Mantell*

IN THE words of the author, "The object of this book is to provide an introduction to electrochemistry in its present state of development. An attempt has been made to explain the fundamentals of the subject as it stands today, devoting little or no space to the consideration of theories and arguments that have been discarded or greatly modified." "In the opinion of the writer (that is, Mr. Glasstone), there have been four developments in the past two decades that have had an important influence on electrochemistry. These are the activity concept, the interionic attraction theory, the proton-transfer theory of acids and bases, and the consideration of electrode reactions as rate processes."

It would have been pleasant to have found a definition of the subject in this volume, but there is none and the reviewer gains the impression that the volume was another which could more properly be entitled "A Physical Chemistry," particularly with chapters on acids and bases which are carefully defined, neutralization and hydrolysis, amphoteric electrolytes, as examples. Other chapters discuss electrolytic conductance and its theory, the migration of ions, free energy and activity, reversible cells, electrode potentials, oxidation-reduction systems, the determination of hydrogen ions, polarization and overvoltage, deposition and corrosion of metals, electrolytic oxidation and reduction, with a concluding chapter on electro-kinetic phenomena. Despite the title "Introduction to Electrochemistry," there is no mention of fused electrolytes or their theory, electrochemistry of gases, electrolysis of concentrated solutions, electroplating of metals, electroforming or electrotyping, or those operations which currently consume a quarter or more of the nation's industrial power.

Apparently the author prefers to define electrochemistry as that part of chemistry which is "mainly concerned with the interconversion of electrical and chemical forms of energy," a definition which is too vague and too general for the present. The more modern definition as "the organized body of chemical knowledge that has been accumulated through the application of electric current or electrical or magnetic fields in the solution of chemical problems and through the measurement of electric current or electric potentials flowing through or generated by chemical cells" would have automatically excluded some of the topics covered in Glasstone's book. The volume, therefore, becomes another of the excellent monographs on certain phases of theoretical and physical chemistry, but does not justify the title "Introduction to Electrochemistry" when a comparison is made with other present-day texts on the theory or principles of electrochemistry.

FIFTH VOLUME. FOURTH EDITION

THORPE'S DICTIONARY OF APPLIED CHEMISTRY. Vol. V. Fourth edition. By *J. F. Thorpe* and *M. A. Whitely.* Published by Longmans-Green & Co., New York, N. Y. 610 pages. Price $25.

THE LATE Sir Jocelyn Thorpe has left an impressive monument in his Dictionary. It is a reference of unquestioned value. The new fifth volume (completed since his death in 1940) carries the definitions and discussions from Feeding Stuffs (last item in the previous volume) through Glass. As usual, the encyclopedic articles have been prepared by outstanding British

authorities. Among the longer articles are those on Fermentation, Formaldehyde, Fuels, Gas (both Coal and Water), and Glass.

A 15-page abridged index to Volumes I-V is also available priced at one dollar. This is "a list of cross-references which would have appeared alphabetically as titles had the Dictionary been published as a complete work."

INDUSTRIAL WATER FOR PULP, PAPER, AND PAPERBOARD MANUFACTURE. Tappi Monograph Series—No. 1. Published by the Technical Association of the Pulp and Paper Industry, New York, N. Y. 145 pages. Price $5.

FIRST of a series of monographs giving detailed information on subjects relating to the technological phases of pulp- and papermaking, this paper-bound booklet deals with a most important item in the industry. A group of experts have been assigned to prepare the various chapters with the result that a condensed but complete and authoritative monograph has been produced. Among the subjects included are filtration, flocculation, disinfection, taste and odor removal, corrosion control, softening, boiler feedwater, and analysis. While the little volume has been prepared specifically for one industry, its usefulness will not be limited because the discussions include all the fundamentals of water treatment.

FATIGUE OF WORKERS. Prepared by the Committee on Work in Industry of the National Research Council. Published by Reinhold Publishing Corp., New York, N. Y. 155 pages. Price $2.50.

Reviewed by *A. G. Cranch*

A LARGE amount of very interesting and useful information is contained in this book. In the mind of this reviewer, however, the title is misleading, and the material itself is presented in such a way as to require close study to obtain any real value. The bulk of the book deals with some of the psychological problems of employment which influence the emotional reaction of employees and which in this way may show various effects on production. The liberal interpretation of the term "fatigue" might include such factors, but certainly the average executive, personnel manager or industrial physician, looking for practical help in controlling the fatigue of workers, would be disappointed in what he would find in this book.

RECENT BOOKS and PAMPHLETS

Producing for War. Prepared by the War Economics Division of the Research Institute of America. Published by the Institute, New York, N. Y. 115 pages. Price $2. An analysis prepared to help American business help win the war. This is an important contribution and would be of considerable assistance to any business man in his attempts to deal

with the government. There are chapters on army and navy buying, how to get war contracts and how to get a sub-contract, inspections and taxes, and improving operating methods. The last two chapters, devoted to production schedules and labor supply are particularly recommended for study by chemical engineers.

Report for 1941. Publication No. 109 of the Tin Research Institute, Greenford, Middlesex, Great Britain. 12 pages. Gratis. A review of the work carried on by research and development groups on tinplate and hot-tinning, electrodeposition of tin, bearing metals, foil, bronzes, and chemical compounds of tin.

What Every Retailer Should Know About the General Maximum Price Regulations. Published by Office of Price Administration, Washington, D. C. This booklet is directed to retailers and tells how to handle the maximum selling prices under the general maximum price regulation and also what information must be filed with OPA.

Endeavour. Published by Imperial Chemical Industries, London. Price 5 shillings. Vol. 1, No. 1 of this new quarterly review has recently come to this country. The purpose of this magazine is to add "to the common understanding of science and of its influence upon the community." It is a slick-paper magazine which apparently is going to deal with all branches of science. The first issue contains an interesting biography of John Glover, inventor of the Glover tower.

Transactions of the Institution of Chemical Engineers. Vol. 18, 1940. 147 pages. Some of the more important papers appearing in this annual publication are: Sedimentation and Flocculations, A Review of Certain Unit Processes in the Reduction of Material, Measurement of the Flow of Liquids and Gases, Salvage of Waste Materials in the Chemical Industry.

The Coming Crisis in Manpower. By *Maxwell F. Stewart.* Published by Public Affairs Committee, New York, N. Y. 32 pages. Price 10 cents. Pamphlet No. 68 is a brief study of the basic problem of balancing our military and naval needs against our industrial requirements for manpower. As a solution of the general problem as it affects both men and women, the pamphlet suggests "Setting up a system of priorities for manufacturing plants and labor skill comparable to the one that now exists for scarce raw materials."

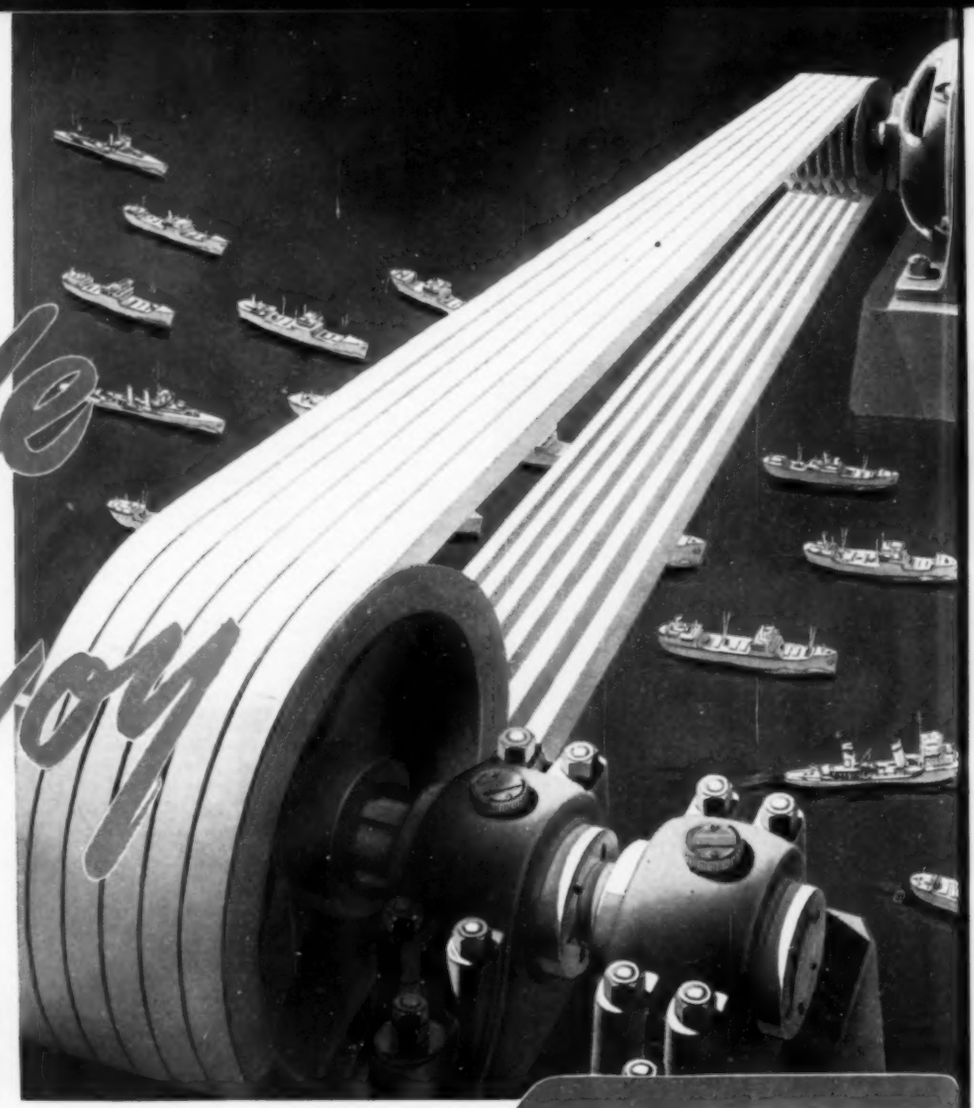
Security for Industrial Plants. Issued by the United States Navy Department. 25 pages. The Navy Department is one of the largest procurement agencies of the government because of the magnitude and diversity of its material requirements. This pamphlet has been prepared as a guide to aid the management of industrial plants in the performance of their accepted responsibility for building and maintaining a security program which will insure continued production of materials essential to the Navy.

Conservation Practice. Bulletin No. 1. Published by American Paper & Pulp Association, New York, N. Y. This is a 4-page folder prepared by the Committee on Conservation of Critical Materials in cooperation with the Technical Association of the Pulp and Paper Industry and the American Pulp and Paper Mill Superintendents Association, Inc. Bulletin 1, first of a projected series, gives a number of practical suggestions for prolonging the life of rubber transmission belts, rubber conveyor belts, rubber V-belts, and for the salvage of rubber belting.

50 Years of Chemical Progress. Published by the Mathieson Alkali Works, Inc., New York, N. Y. 48 pages. An illustrated booklet tracing the growth of the Mathieson organization and describing the company's major developments.

Chemical Dictionary. By *F. H. Campbell.* This is a reprint by some photolithographic process of the book reviewed in *Chem. & Met.* July 1941, p. 147. It is available from the Chemical Publishing Co., Brooklyn, N. Y. Price $2.50.

How to Run a Lathe. 41st edition. By *J. J. O'Brien* and *M. W. O'Brien.* Published by the South Bend Lathe Works, South Bend, Ind. 128 pages. Price 25 cents. A handy, inexpensive booklet in which fundamental operations of modern lathe practice are illustrated and described for the purpose of aiding apprentices and other inexperienced workers.



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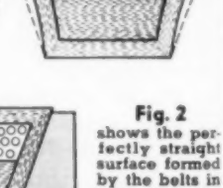


Fig. 1 shows D-V Belts with concave side walls.

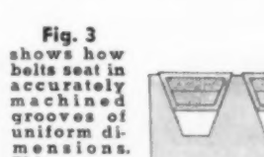
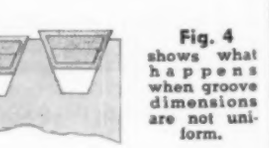


Fig. 2 shows the perfectly straight surface formed by the belts in contact with the groove when flexing over a sheave.

Fig. 3 shows how belts seat in accurately machined grooves of uniform dimensions. This means even "pull" with no loafing belts.



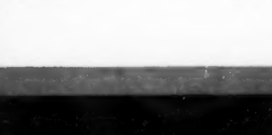


Fig. 4 shows what happens when groove dimensions are not uniform.

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, express order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

Trade and Professional Associations of the United States. By C. J. Judkins. Bureau of Foreign and Domestic Commerce, Industrial Series No. 3. Price, 70 cents. An elaborate volume describing activities and commodities of interest as well as giving a directory of the associations.

Portable Chemical Cylinder. War Department, Technical Manual TM 3-315. Price, 15 cents.

Military Roentgenology. War Department, Technical Manual TM 8-275. Price, 30 cents.

Survey of Roofing Materials in the South Central States. Bureau of Standards, Building Materials and Structures Report No. 84. Price, 15 cents.

Multiple-Coated Porcelain-Enameled Steel Utensils. Bureau of Standards. Commercial Standard CS100-42. Price, 5 cents.

Tennessee Valley Authority Act. Tennessee Valley Authority. Price, 10 cents. A summary of the law with amendments as now in force giving authority for T.V.A. operations of all types.

Plant Efficiency. War Production Board, unnumbered pamphlet. Ideas and suggestions on increasing efficiency in smaller plants.

Explanation of Principles for Determination of Costs Under Government Contracts. Unnumbered pamphlet prepared by joint cooperation of War and Navy Departments. Gives details of accounting practice which must be met by all companies selling to the government.

Changes in Cost of Living in Large Cities in the United States 1913-1941. Bureau of Labor Statistics, Bulletin No. 699. Price, 15 cents.

What Wartime Price Control Means to You. Office of Price Administration. A special issue of "Consumer Prices," No. 23, May 1942.

Nutritive Properties of Lard and Other Shortenings. By Ralph Hoagland and George G. Snider. Department of Agriculture, Technical Bulletin No. 821. Price, 5 cents.

Magnetic Separation of Ores. By R. S. Dean and C. W. Davis. Bureau of Mines, Bulletin 425. Price, $1.

Specific Volumes and Phase-Boundary Properties of Separator-Gas and Liquid-Hydrocarbon Mixtures. By Kenneth Eilerts and R. Vincent Smith. Bureau of Mines, Report of Investigations 3642; mimeographed.

Some Photometric Instruments Used in X-Ray Diffraction and Spectographic Methods of Analysis. By James W. Ballard, Howard I. Oshry and H. H. Schrenk. Bureau of Mines, Report of Investigations 3638; mimeographed.

Concentration of Manganese-Bearing Ore from the Stange Mine, Bland County, Va. By S. M. Shelton, M. M. Fine, J. B. Zadra and R. B. Fisher. Bureau of Mines, Report of Investigations 3633. No. 12 of Ore-Dressing Studies of Manganese Ores. Mimeographed.

Concentration of Manganese-Bearing Ore from the Mayfield Property, Van Horn, Texas. By J. B. Zadra, M. M. Fine, S. M. Shelton, and T. L. Johnston. Bureau of Mines, Report of Investigations 3632. No. 13 of Ore-Dressing Studies of Manganese Ores. Mimeographed.

List of Permissible Mine Equipment Approved to January 1, 1942. By L. C. Ilsley. Bureau of Mines, Information Circular 7207; mimeographed.

New Process for Controlling Mercury Vapor. By Merle Randall and H. B. Humphrey. Bureau of Mines, Information Circular 7206; mimeographed.

Carbonizing Properties and Petrographic Composition of Lower Hignite-Bed Coal from the Atlas Mine, Middlesboro, Bell County, Ky., and the effect of blending this coal with Pocahontas No. 3 and No. 4 bed coals. By J. D. Davis, D. A. Reynolds, G. C. Sprunk and C. R. Holmes. Bureau of Mines, Technical Paper 634. Price, 10 cents.

Oil-Reservoir Behavior Based Upon Pressure-Production Data, by H. C. Miller. Bureau of Mines, Report of Investigations 3634. Mimeographed.

Methods for Determining Permeability of Water-Bearing Materials with Special Reference to Discharging-Well Methods, by L. K. Wenzel and V. C. Fishel. U. S. Geological Survey, Water-Supply Paper 887. Price, 60 cents.

Interstate Trade Barriers and Michigan Industry, 1941, by E. H. Gault and E. S. Wolaver. Bureau of Foreign and Domestic Commerce, Economic Series No. 15. Price, 10 cents.

Marketing Natural Mineral Pigments, by Charles L. Harness. Bureau of Mines, Information Circular 7198. Mimeographed.

Chalk and Whiting, by Oliver Bowles, Bureau of Mines, Information Circular 7197. Mimeographed.

Improved Method of Determining Benzene in Medium-Temperature Light Oils, by L. P. Rockenbach and D. A. Reynolds. Bureau of Mines, Report of Investigations 3619. Mimeographed.

Review of the Heaving-Shale Problem in the Gulf Coast Region, by Gustav Wade. Bureau of Mines, Report of Investigations 3618. Mimeographed.

Tentative Coal-Mine Inspection Standards. Bureau of Mines, Information Circular 7204. Mimeographed. A safety code.

Development of the Sand and Gravel Industry, by Shirley F. Colby. Bureau of Mines, Information Circular 7203. Mimeographed.

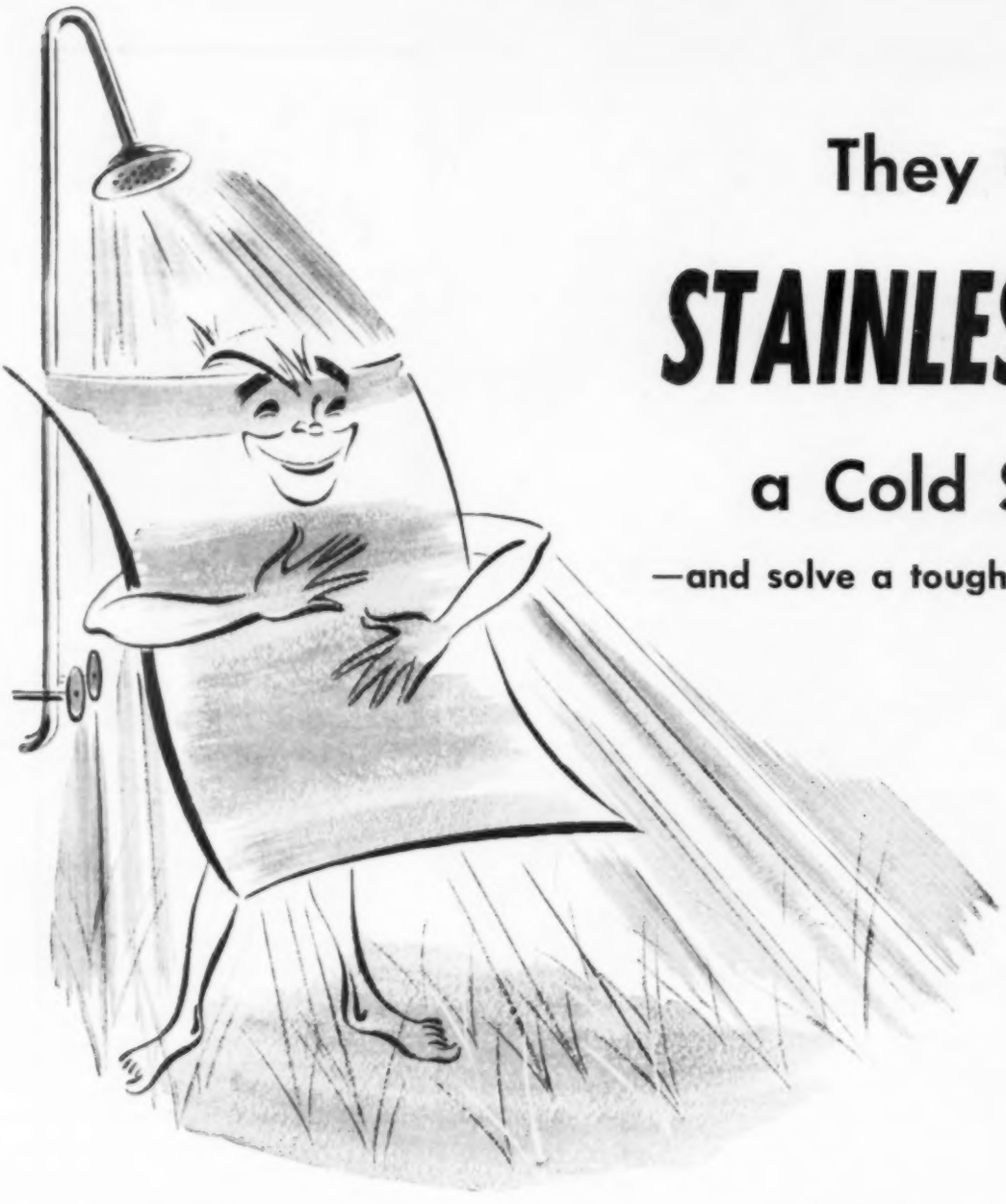
Marketing Silica (Quartz, Tripoli, Diatomite, etc.), by Nan C. Jensen. Bureau of Mines, Information Circular 7202. Mimeographed.

Capacities of Gypsum Processing Plants. By Forrest T. Moyer. Bureau of Mines, Mineral Market Report No. 1002; mimeographed.

Mineral Data for 1941. The Bureau of Mines annual mimeographed releases giving data for production of metals and minerals during 1941 are now practically all available. These statistics are a preliminary form of data which later make up the Minerals Yearbook statistics. Requests should indicate clearly exactly which metals or minerals are of interest, as separate releases of one to six or eight pages are issued under the M.M.S. series of the Bureau as soon as complete figures are available in a preliminary form for any particular commodity.

Emergency Specifications. Many additional revisions of governmment specifications have been completed recently modifying requirements for government purchases to conserve scarce materials or simplify war-time supplies for the government. During May, a long list of revised detergent, soap, and soap product specifications were published. Another series covers rather completely the revision of paint, varnish, enamel and related finishes and pigments. Those interested in these specifications should identify the commodity of interest and request the "Emergency Alternate Federal Specification" from Federal Catalog Division, Procurement Division Building, Washington, D. C.

Federal Specifications. New Federal Specifications have recently been issued for the following commodities at the price of 5 cents each for: Calcium-chloride (for road and building-construction), O-C-106. Oil, castor, technical-grade, JJJ-O-318. Soap-borax-compound, toilet (for), dispensers, P-S-628. Aluminum-pigment, powder and paste (for), paint, TT-A-468. Ultramarine-blue, dry, paste-in-japan, paste-in-oil, TT-U-451a. Benzol (benzene), technical-grade, VV-B-231. Sealer, floor; lacquer-type (for oiled wood floors), TT-S-171. Tar; pine, technical-grade, JJJ-T-121. Wax; carnauba, JJJ-W-141. Wax, floor; water-emulsion, P-W-151a.



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Although we do not make steel, we have for more than 35 years produced "Electromet" ferro-alloys used in the making of steel. With the knowledge accumulated from this experience we are in a position to give impartial advice on the selection and use of stainless steels. If you have a specific problem in the use, maintenance, or fabrication of stainless steel, consult us.

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Air Conditioners. Air & Refrigeration Corp., 475 Fifth Ave., New York, N. Y.—A.I.A. File 30F—24-page booklet entitled "Capillary Air Conditioners." Explains principles of the capillary cell, its functions, evaporative cooling, cooling and dehumidifying with such conditioners, adaptation of capillary cells to air conditioning apparatus, and engineering and performance data. Gives extensive cross-sectional drawings, specifications, standard dimensions and capacities, methods of industrial calculations and other engineering data. Extensively illustrated.

Alloys. Cramp Brass & Iron Foundries, Div. of Baldwin Locomotive Works, Philadelphia, Pa.—40-page catalog on this concern's line of brass, bronze and iron alloys. Designed as an engineering reference catalog for all these alloys, giving composition, applications, physical properties and other data on 31 alloys. Includes photographs of products made of these alloys, gives a list of the concern's brass and iron products, and describes effect of various elements on iron. Extensively illustrated.

Blackout Ventilation. Ilg Electric Ventilating Co., 2850 No. Crawford Ave., Chicago, Ill.—Bulletin 304—4-page folder entitled "Blackout Your Windows But Not Your Ventilation." Describes a typical solution using this concern's ventilators for blackout in plants. Illustrated by photographs and drawings.

Cartridge Handling. The Cambridge Wire Cloth Co., Cambridge, Md.—Bulletin 77—8-page folder describing this concern's line of wire baskets and crates for annealing, pickling and washing cartridge cases. Describes briefly and illustrates the various cases and their design.

Castings. Hammond Brass Works, 1844 Summer St., Hammond, Ind.—20-page booklet containing practical data on this concern's line of brass and bronze castings. Gives in handy and simplified form answers to many questions relative to designing, engineering, and purchasing such castings. Gives typical composition and physical properties, federal, U. S. Navy and SAE specifications and other engineering data. Extensively illustrated.

Cleaning Steel.—Republic Steel Corp., Alloy Steel Division Sales Office, Cleveland, Ohio—Cardboard wall charts dealing with the conservation of stainless steel and details on methods of how to clean Enduro stainless steel equipment. One chart gives simple suggestions for longer service life for stainless steel in the process and chemical equipment industries, another deals with pulp and paper equipment, and the third with textile equipment.

Density Recording Instruments. The Foxboro Co., Foxboro, Mass.—Bulletin A-264—8-page folder dealing with this concern's liquid density recorder for the automatic measurement and recording of densities of process liquids to replace periodic readings by hydrometer and still samples. Contains engineering information on the unit and photographic and drawing illustrations.

Diaphragm Slurry Pumps. Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.—Bulletin 307-R—4-page folder dealing with the diaphragm slurry pump put out by this concern. Includes a discussion of application, outstanding features and recommended hook-ups. Contains engineering data in table form. Illustrated.

Electrical Equipment. General Electric Co., Schenectady, N. Y.—Bulletin GEA-3804—2-page sheet which illustrates and describes briefly the line of air-break combination starters for hazardous-gas locations put out by this concern. Gives outstanding features, dimensions, and other specifications.

Electric Photometer. Photovolt Corp., 95 Madison Ave., New York, N. Y.—8-page pamphlet dealing with this concern's electric photometer for measurement of low light values. Gives information on applications, spectral response of phototubes, indicating instruments, sensitivity, photographic applications, accessories, price list, etc. Provides considerable information in text and graph form. Illustrated.

Equipment. S. F. Bowser & Co., Inc., Fort Wayne, Ind.—40-page booklet which describes and illustrates the line of industrial equipment put out by this concern. Includes equipment used for filtration and distillation, lubrication, metering, pumping, refueling, storage and dispensing, and other operations. Includes specifications and other engineering data on each unit.

Filter Paper. Carl Schleicher & Schueli Co., 116 West 14th St., New York, N. Y.—Bulletin 65—12-page bulletin which lists the types of analytical filter papers produced by this concern from 100 percent American labor, raw materials and capital. Lists the applications of the various grades, and gives a description of the paper and specifications of various sizes.

Fire Prevention. Erie Supply & Equipment Co., 426 Huron Ave., Sandusky, Ohio.—Sheet which describes briefly this concern's new fire extinguisher tamproof box for protection against sabotage or accident. Describes outstanding features of the box, how fire extinguishers can be sabotaged if not inclosed in a tamproof box and other similar information.

Instruments. C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y.—Catalog 900-E—36-page catalog on this concern's non-indicating temperature and pressure controllers of various types. Contains illustrations and discussion of the various units, with specifications, features of design and construction, industrial applications, etc. Gives considerable engineering information and cross-sectional drawings as well as numerous photographs.

Kiln Firing in Ceramic Industry. The Selas Co., Kiln and Furnace Div., Philadelphia, Pa.—Reprint of address before American Ceramic Society entitled "A Factual Report on Direct Radiant Kiln Firing in Various Branches of the Ceramic Industry." Summarizes experience of the ceramic industry with the new technique of kiln firing by combustion of gaseous fuels "catalytically" on the concave surfaces of incandescent ceramic cups distributed over kiln walls without muffles, baffles, or fire tubes between burning gases and ware. Contains considerable engineering data in text, diagrammatic drawings, and charts. Extensively illustrated.

Lathe Operation. South Bend Lathe Works, South Bend, Ind.—List and condensed description of the six publications issued by this concern for apprentice training for lathe operation. Gives the price of each of the publications.

Lead-Coated Equipment. The United States Stoneware Co., 60 East 42d St., New York, N. Y.—Bulletin 1700—12-page booklet giving information on this concern's lead-lined equipment in the process field. Discusses anti-corrosive properties of lead coatings, applications of this concern's non-metallic flux in combination with chemically pure lead, method of applying lead coatings and homogeneous bonding of sheet lead-lined equipment. Extensively illustrated.

Motor Maintenance. Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—New handbook entitled "A Guide to Wartime Care of Electric Motors," designed to aid in efficient operation of motors

at 168 hours per week instead of 40 hours as formerly. Designed for war plant engineers and maintenance men, but of particular value for training new men.

Plant Conversion. Lyon Metal Products, Inc., Aurora, Ill.—Bulletin 355—20-page illustrated folder which shows how this concern tackled the war production problem and converted more than 50 percent of its productive capacity from non-essential to war goods. Outlines briefly the logical steps to be taken by any concern for conversion of plant capacity to war production.

Pressure Vessels. Lenape Hydraulic Pressing & Forging Co., West Chester, Pa.—Catalog 842—32-page catalog dealing with this concern's standard line of accessories for pressure vessel construction. Gives engineering information on welding necks, nozzles, elliptical manholes and handholes, and forged specialties, including boiler flanges, studding outlets, and others. Contains engineering information on specifications, materials of construction, installation, flange facings, pressure ratings, and strength of materials at elevated temperatures. Extensively illustrated by photographs and diagrammatic drawings.

Priorities. Manning, Maxwell & Moore, Inc., Bridgeport, Conn.—16-page booklet entitled "Priorities Mobilize Production for Victory." Explains priorities and how to use them. Covers such topics as "Principles of the Priorities System," "Procurement of Materials for Manufacture," "The Acceptance of Orders," "Securing and Extending of Priority Ratings," "Scheduling Production and Delivery." Reproduces different types of forms and certificates to be used by jobbers or customers of this concern. Published to assist this company's jobbers, salesmen and customers, but helpful to all concerns having to deal with priority problems.

Pumps and Compressors. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin W312B2C—4-page folder which describes briefly advantages and operating principles of this concern's single-stage volute centrifugal pumps Nos. 3 to 6 in capacities to 2,000 gal. per min. and heads to 300 ft. Includes data on dimensions and other engineering data. Illustrated. Also Bulletin L640S2—6-page folder describing single horizontal, single-stage compressors of 9 in., 11 in., and 13 in. stroke. Describes performance, operation, and outstanding features. Contains a table of general engineering data and cross-sectional drawings.

Pumps. The United States Stoneware Co., 60 East 42nd St., New York, N. Y.—Bulletin 702—4-page folder describing this concern's line of centrifugal acid pumps for all corrosive solutions, hot or cold. Describes outstanding features of the pumps, their characteristics, performance curves, and gives condensed specifications and selection data. Illustrated.

Pump Maintenance. Quimby Pump Co., 340 Thomas St., Newark, N. J.—12-page booklet designed as a stationary instruction manual and giving installation, operation and maintenance data on pumps. Presents engineering aspects of proper installation of pumps, piping, starting of pumps, packing materials, dismantling and reassembly, and care of idle pumps. Discusses in detail such items as foundation bolts, grouting, hot liquid pump piping, relieve valves and priming. Full of practical helps. Well illustrated.

Rubber Conservation. The B. F. Goodrich Co., Akron, Ohio—Seventh in the series of vest-pocket size pamphlets dealing with the care and conservation of industrial rubber products. This pamphlet deals with rubber gloves and describes how to get the most service from electrician, acid, and other industrial type rubber gloves. Other pamphlets available deal with industrial rubber products, transmission belting, conveyor belts, V-belt drives, belt salvage, rubber hose and matting.

Rubber Conservation. U. S. Rubber Co., Rockefeller Center, New York, N. Y.—48-page illustrated book on conservation of rubber products in industry, with complete and explicit suggestions for proper care of these products from initial design through inventory and stor-

age to use, maintenance, inspection and repair. Includes data on all mechanical rubber goods, such as hose of all types, transmission, conveyor and elevator belts, mechanical packings, electrical tapes, wire and cables, molded and extruded rubber goods.

Rubber-Lined Barrels. The B. F. Goodrich Co., Akron, Ohio—Catalog Section 9030—2-page section on this concern's line of barrels and drums lined with rubber by the "Vulcalock Process" for safe handling of corrosives. Describes properties and limitations of the drums with details of construction and uses. Illustrated.

Rubber Sponge. The B. F. Goodrich Co., Akron, Ohio—Catalog Section 8010—4-page section which illustrates and describes the recently announced synthetic rubber sponge put out by this concern. Gives properties, available sizes and forms, and a table comparing the new synthetic rubber with natural rubber sponge.

Safety Equipment. Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.—8-page folder illustrating and describing briefly the line of personal safety equipment put out by this concern. Includes information on helmets, respirators, protective suits, safety goggles, fire blankets, and the concern's new folding stretcher outfit and wood traction splint.

Smoke Density Recorders. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.—Catalog N93163—16-page, revised catalog on the line of smoke density recorders put out by this concern. Describes the recorders, their principles of operation, installation, and outstanding features. Illustrated by photographs and cross-sectional drawings, showing mounting dimensions.

Speed Control. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin B-6082A—16-page booklet describing this concern's stationary and motion-control sheaves, including operating diagrams, sizes and dimensions. Extensively illustrated.

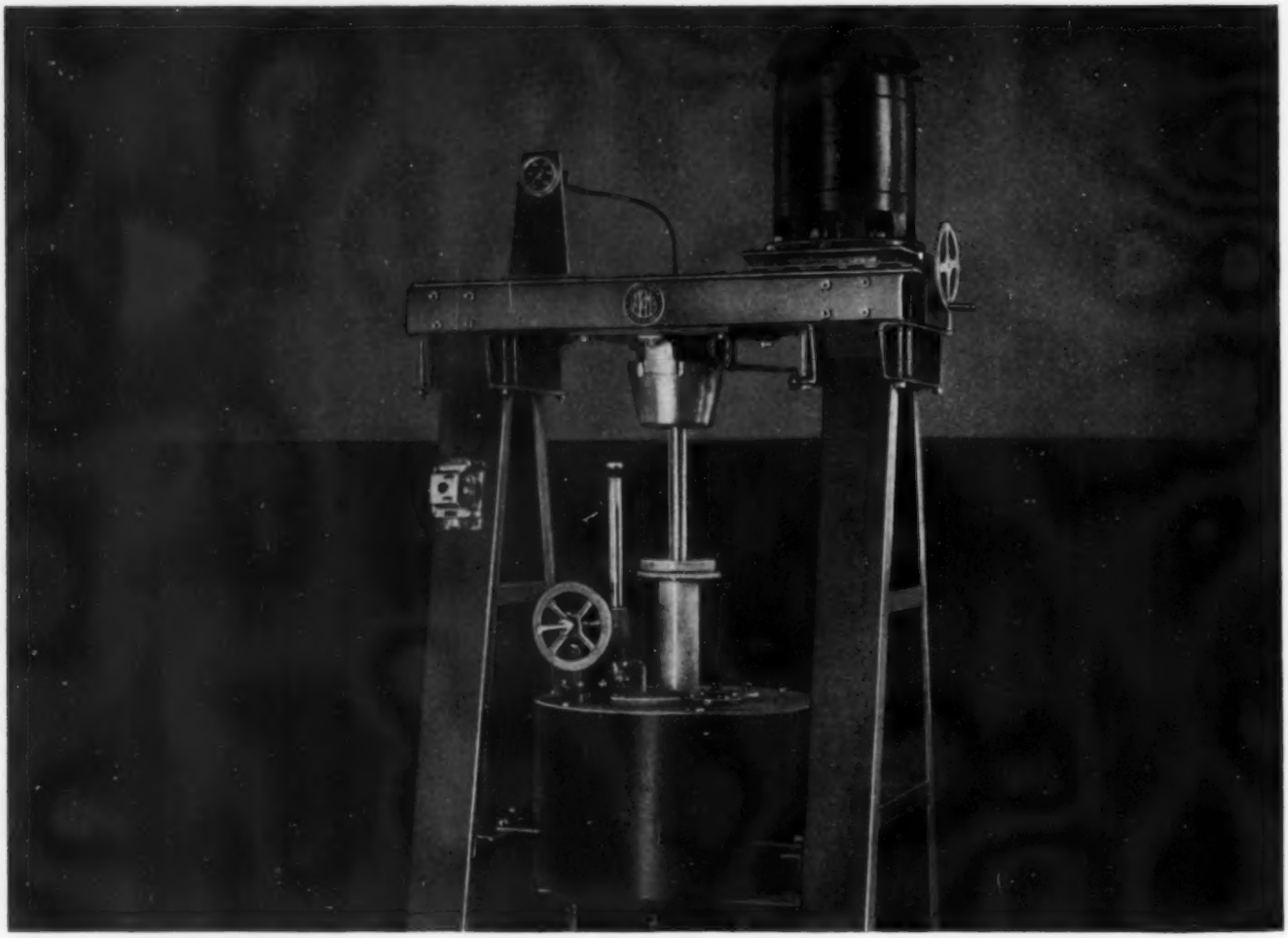
Speed Recorders. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.—Catalog N27—12-page catalog on this concern's equipment for measuring and recording speed of rotating machinery, such as rotary kilns, dryers, paper machines, and other continuous process machinery. Describes and illustrates with photographs and cross-sectional drawings principles and operations of the units. Includes data on specifications.

Stainless Steel Equipment. Edward G. Budd Mfg. Co., Philadelphia, Pa.—8-page pamphlet which illustrates and describes briefly the use of this concern's stainless steel fabrication for the chemical and process industries. Also contains a brief discussion of the Shotweld process for spot welding.

Steel Pickling. The Enthone Co., 442 Elm St., New Haven, Conn. — 12-page booklet describing this concern's acid addition agent to be used in both cold hydrochloric and hot sulphuric acid pickles for iron and steel to give faster pickling, reduce attack upon the steel, save acid and reduce fumes. Describes the theory of pickling, uses for an acid addition agent, pickling before plating, electrolytic pickling, etc.

Switching. General Electric Co., Schenectady, N. Y.—GEA3756—16-page illustrated booklet which describes the function and applications of this concern's 25-ton diesel-electric for industrial switchings. Contains engineering data on the locomotive, its capacity, and auxiliary parts.

Synthetic Resin Tubing. Arcadia Synthetic Products Division, Western Felt Works, 4115 Ogden Ave., Chicago, Ill.—16-page notebook dealing with "Saran" synthetic resin tubing for replacing copper tubing for various purposes. Gives tabulated physical, chemical, and electrical properties as well as a discussion of uses of the tubing where resistance to solvents and acids is required. Also contains a number of charts showing bursting and working pressure of the various types of tubing at different temperatures. An extensive price list is included.



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An A T & M centrifugal that packs twice as many man-hours into each working hour . . . or twice as much production into the same or less floor space . . . is not exceptional in the process industries today.

Consider extraction processes, for instance. In this one type of operation alone, hundreds of firms formerly using filters, squeeze rolls, vacuum boxes or drying ovens have saved time of process, floor space, power costs — often cutting general production costs enough to pay for centrifugal installations in a very short time.

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A T *and* M

A T & M CENTRIFUGALS SAVE TIME AND SPACE

Tanks. Buffalo Tank Corp., Dunellen, N. J.—First Edition—288-page, leather-bound handbook containing extensive information on welded steel plate construction, design data for oil and water storage tanks, pressure vessels, tank heads, smokestacks, brewery tanks and equipment, etc. Also contains extensive information on air, water, gas, steam, heat, bolts and staybolts, pipe tubes. Extensive engineering tables give capacities of tanks, physical properties of metals, weights of steel plates, specific gravities, etc. Well illustrated by drawings and photographs. Substantially bound and valuable as an engineering reference book.

Tool Brazing. Handy & Harman, 82 Fulton St., New York, N. Y.—Two-page sheet dealing briefly with the use of this concern's "Easy-Flo" for low temperature brazing and repair of tools. Illustrated.

Turbines. DeLaval Steam Turbine Co., Trenton, N. J.—Three sheets which briefly describe this concern's improved velocity-stage turbines. Describes the units, their principal parts, method of operation, and outstanding features. Includes installation and cross-sectional photographs.

Vacuum Pumps. F. J. Stokes Machine Co., Tabor Road, Olney P. O., Philadelphia, Pa.—Catalog 38P—30-page catalog on the line of high-vacuum pumps put out by this concern. Illustrates the various units of different capacities, describes their construction and method of maintaining vacuum within the micron range and gives considerable engineering data in the form of specification charts, cross sectional drawings, graphs and text form. Describes structural features and advantages of the units, operating principles, performance, volumetric efficiency, and typical installations. Extensively illustrated.

Valves. Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.—Bulletin E100—32-page bulletin describing this concern's quick-operating valves for blow-off, water columns and other boiler room services. Illustrated with self-explanatory views which show the design and construction of the various types of valves. Text material describes features of the designs. Includes tables of specifications, prices and numerous cross-sectional drawings.

Vibrating Equipment. W. Richard Witte & Co., 220 Broadway, New York, N. Y.—Bulletin 42—8-page bulletin dealing with this concern's vibrating equipment for feeding, conveying, sifting, packing, cooling, drying, etc. Illustrates and describes briefly each of the units.

Water Purification. West Virginia Pulp & Paper Co., Industrial Chemical Sales Division, 230 Park Ave., New York, N. Y.—92-page booklet entitled "Taste and Odor Control in Water Purification." Contains a historical review of ancient and modern water supplies together with chapters giving engineering data on sources of taste and odor pollution, the threshold odor test, effect of water treatment processes on taste and odor, methods of use for activated carbon, determining carbon dosage, carbon filters, super-chlorination method of odor control, etc. Well organized and illustrated with photographs, diagrammatic drawings, and charts. Each chapter is contributed by a specialist.

Water Treatment. Graver Tank & Mfg. Co., Inc., East Chicago, Ind.—Bulletin 310—Bulletin covering this concern's new chemical proportioner to provide accurate control of the feed of chemicals into water treating plants in proportion to the volume of water. Describes the unit, its outstanding features, method of operation, and other advantages.

Wire Products. Newark Wire Cloth Co., 351-365 Verona Ave., Newark, N. J.—Catalog C—116-page bound handbook of information on this concern's woven wire screen and wire cloth products. Contains a glossary of wire cloth terms, technical information on how to order wire cloth, and extensive engineering tables containing data on openings, diameter of wire, percent open area, weight in pounds per square foot, and list prices per square foot for various metals. Contains information on space and mesh cloth, metallic filter cloth, testing sieves, and similar products.

TIME is short. Supplies of critical metals are even shorter. How can you get those copper and copper alloy tanks, evaporators, separators, stills, digesters, accumulators, condenser or heat exchanger shells you *must* have to keep going?

Revere's new Bimetal may be the answer. If it is, you'll get strong, sound metal for your vessels, clad with the right alloy.

Revere can supply bonded Bimetal sheets and plate of S.A.E. 1010 carbon steel clad with copper as well as certain other metals and alloys. Cladding can be provided on one or both sides. Revere Bimetal is made by a method which produces a dependable and superior bond.

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VARIOUS FACTORS CONTRIBUTE TO LOWER INDUSTRIAL CONSUMPTION OF CHEMICALS

CHEM & MET ECONOMICS & MARKETS

PRODUCTION data continue to report a rising volume of output for all industry with the Federal Reserve Board Index for May placed at 176 or a gain of three points over that for the preceding month. On the same authority, the unadjusted index for chemical production is 168 for May as compared with a revised figure of 167 for April. On this comparison, chemical production while still moving upward is not keeping pace with the rise in all industry. The *Chem. & Met.* index for consumption of chemicals, which does not include operations in the direct war industries, is turning downward. Government controls over distribution are important factors in this situation but other influences also are at work. In the case of fertilizers, the movement of raw materials slows up at this time of year and this seasonal condition is now evident. Furthermore, it is probable that consumption of sulphuric acid in the manufacture of sulphate of ammonia will be materially reduced for some months with a somewhat corresponding increase in output of ammonia, either anhydrous or liquor. While the total of over-all production will not be greatly changed, the ammonia will go into munitions and not into fertilizer and will not be reflected in the index for consumption.

Use of chemicals in paper mills also has been declining as consumers stocked up some months ago and have been working on inventories. While a resumption of active consumer demand might be expected by September, it is now indicated that restrictions will be placed on production with stress being given to the selective requirements of the armed forces. Conditions in the petroleum industry have also worked toward a slowing up in refining operations but in the latter part of last month refineries were more active and further improvement will be contingent on the shipping situation. Work at steel plants has been moving along at a fairly uniform rate. Call for glass containers remains high and monthly outputs are unusually large. Manufacture of window glass has been stimulated by the large building programs but plate glass moves in very small volume with but little prospect of improvement until automotive production is resumed on a more normal scale.

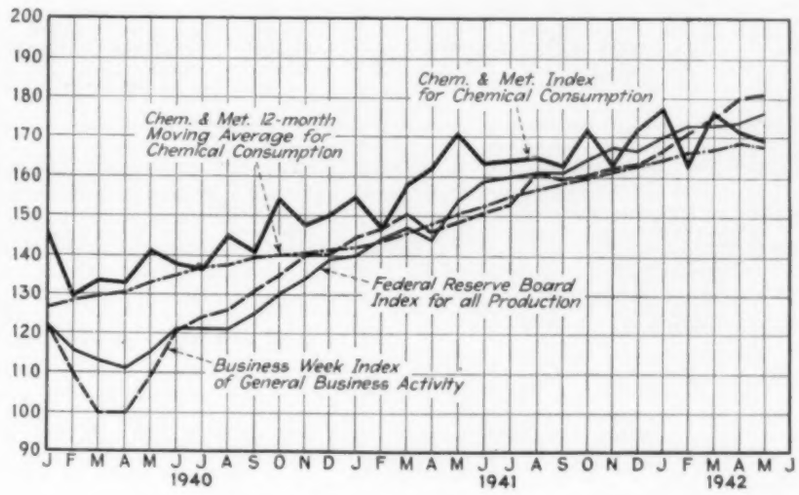
With some of the important consuming outlets thus adversely affected, the index for chemical consumption in May fell to 169.02 as compared with a revised figure of 171.38 for April. Last year the index for May was 170.45 and for April, 161.96. Another indication of the drop in consumption of certain chemicals is found in the fact that many of those which were difficult to obtain a few months ago have been offered rather freely of late. Difficulty in engaging cargo space likewise restricted the export movement and contributed to spot stocks of chemicals. WPB announced on June 26 that ilmenite had been removed from inventory restrictions and added that production would be ample for all domestic needs which takes titanium pigments from the scarce category.

With no data available for activities at rubber plants, nothing definite can be said about consumption of rubber chemicals but it seems safe to assume that the drop in tire output and in rubber goods has held operations at plants below the rate maintained last year but the projected programs for synthetic rubber production will open up new outlets for a varied line of chemicals when they come into operation.

Because of a possible bottleneck in transportation later in the year, the Government has encouraged the movement of plentiful materials so as to build up inventories. Coal and coke, sulphur, and phosphate rock are among the commodities for which chemical plants have been asked to accumulate stocks. The advisory shippers boards have estimated an increase for car requirements for the third quarter but no longer give an estimate for the movement of chemicals.

Chem. & Met. Index for Industrial Consumption of Chemicals
1935 = 100

	April	May
Fertilizers	34.21	32.50
Pulp and paper	22.42	21.06
Petroleum refining	13.70	13.97
Glass	16.70	16.88
Paint and varnish	16.40	15.97
Iron and steel	13.13	13.73
Rayon	14.68	14.97
Textiles	12.24	11.95
Coal products	9.51	9.98
Leather	4.97	4.90
Industrial explosives	5.99	5.91
Rubber	3.00	3.00
Plastics	4.43	4.20
	171.38	169.02

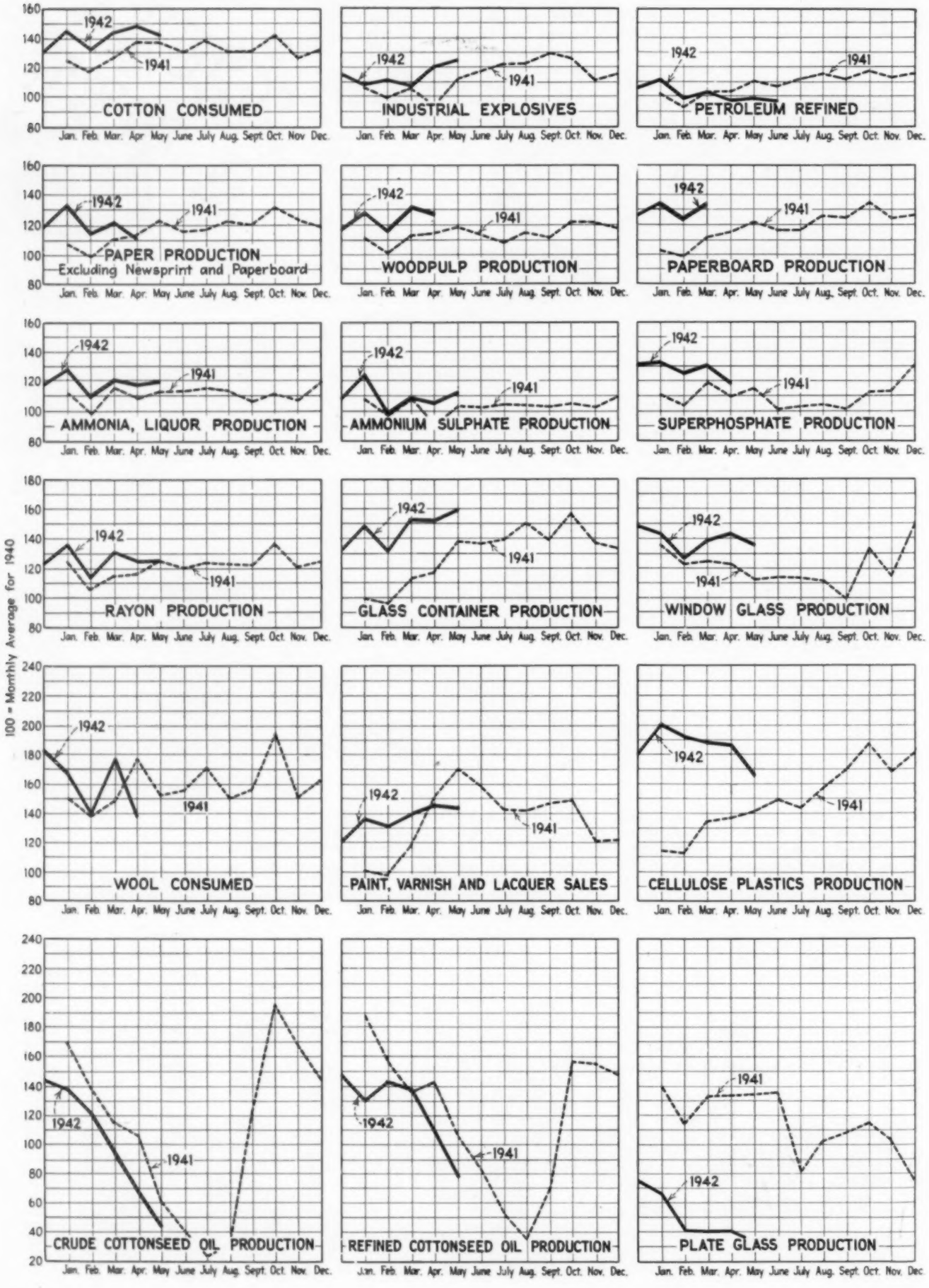


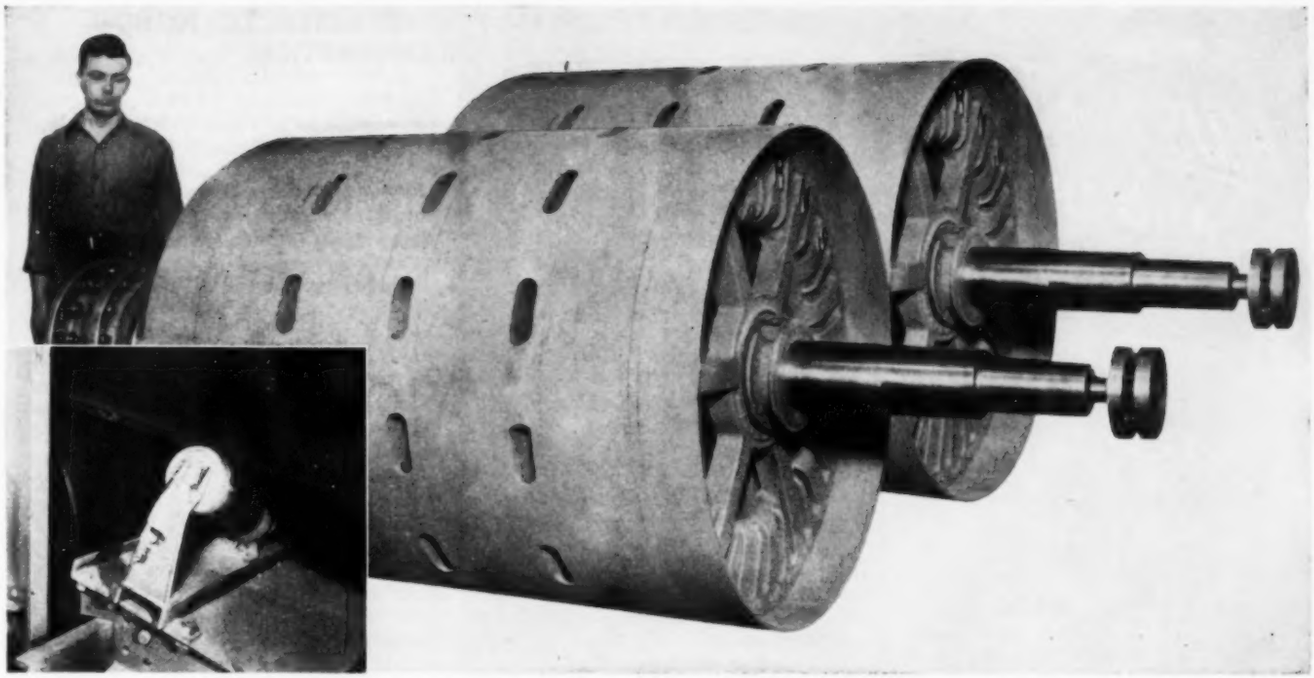
Production and Consumption Data for Chemical-Consuming Industries

	May 1942	May 1941	January-May 1942	January-May 1941	Percent of gain for 1942
Production					
Ammonia, liquor, 1,000 lb	5,633	5,310	28,063	25,788	8.8
Ammonium sulphate, tons	66,874	61,480	320,002	306,888	4.3
Byproduct coke, 1,000 tons	5,276	4,852	25,499	23,783	7.2
Creosote oil, 1,000 gal	3,885	3,514	16,812	14,654	14.7
Glass containers, 1,000 gr	7,192	6,243	33,768	25,578	32.0
Plate glass, 1,000 sq. ft	4,310	18,394	30,188	90,019	66.5*
Window glass, 1,000 boxes	1,557	1,282	7,880	7,057	11.7
Cellulose acetate plastics, 1,000 lb.					
Sheets, rods, and tubes	465	524	2,704	2,352	15.0
Molding composition	3,179	2,319	17,696	10,316	71.5
Nitrocellulose plastics, 1,000 lb	1,296	1,372	7,139	6,398	11.6
Rayon yarn, 1,000 lb	39,000	38,600	194,900	176,500	10.3
Steelbarrels, drums, heavy, 1,000	1,780	1,584	10,060	6,608	52.2
Consumption					
Cotton, bales	957,015	923,518	4,762,054	4,337,502	9.8
Cottonseed oil, bbl	198,655	373,170	1,173,304	1,760,790	33.3*
Industrial explosives, 1,000 lb	40,545	37,891	192,444	175,310	9.8
Paint, varnish, sales, $1,000	49,204	58,413	240,025	218,857	9.7

*Percent of decline.

Production and Consumption Trends





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TRADING IN CHEMICALS FURTHER RESTRICTED BY NEW CONTROLS OVER DISTRIBUTION

WITH requirements in essential industries constantly increasing, government controls over distribution of chemicals is being steadily extended and such a large part of production moves from plants under outside direction that the market is void of competitive selling and trading in the open market is of minor importance. Last month ethyl cellulose was placed under complete allocation. While production is larger than ever before, orders carrying preference ratings of A-10 or higher were taking stocks for which nitrocotton, pitch, tar, and other substitutes were available. The new order was designed to limit use of ethyl cellulose to places where substitutes are inadequate. The order excepts deliveries of 50-lb. lots but for larger amounts, orders must be filed before the 15th of the month preceding the month of delivery and producers must file a schedule of deliveries and report the amount available for delivery in the succeeding month.

Butadiene because of its importance in the synthetic rubber program is another chemical which came under full allocation effective July 1. Producers who make less than five tons a month are excepted in the order but others may not use or deliver to anyone except as specifically authorized. They are requested to use Form PD-33 which covers production and shipment of chemicals used in the manufacture of synthetic rubber.

Distribution of thermoplastics also came under control. War orders are to be given preference. Civilian uses are divided into four classes. Class one includes essential equipment for transportation, communications, industrial plants, health supplies, food production and distribution, technical and safety uses and housing. Class two covers commercial equipment, school and educational supplies, automobile and bicycle parts, household appliances and essential personal items. Class three relates to less essential commercial, household and personal items. Class four includes articles primarily ornamental or non-essential. After class one orders are filled the remaining supply is to be used to fill orders of class two up to 50 percent and anything left to be equally divided between orders of classes three and four up to Sept. 1 when class four will be discontinued.

The limiting order affecting cellophane has been amended to further restrict its use. The original order covered sheets of .005 inches or less and the amendment covers cellophane or other transparent cellulose sheets of .003 inches or less. The new order also prohibits use of cellophane in window cartons, for carton overwraps, for packaging animal food, rubber nipples, and candy. The order was issued not only to conserve cellophane but also such important raw materials as high alpha sulphite pulp, sulphuric acid, plasticizers, chlorine, glycerine, and caustic soda.

Effective June 24, users of cadmium, and this includes all cadmium salts, must obtain authorization from WPB by filing Form PD-441 before delivery can be made or accepted. Potential requirements of the armed services are reported to be larger than the entire supply and substitutes are available for less essential purposes. Consumption of cobalt in ground coat frit was limited in any one quarter to 35 percent of the amount of cobalt used in the first six months of 1941. This has been changed to permit the use of cobalt-nickel oxide which cannot be practically separated into cobalt and nickel.

Restrictions on the use of chrome chemicals have been eased through revisions of orders M-53 and M-18-b. The latter lifts the restriction on manufacture of chrome pigments from 90 percent of the base period, the year ended June 30, 1941, to 100 percent. Use of chrome chemicals in ceramics, soap and glass, heretofore prohibited, is limited to 100 percent of the base period. In roofing materials, 50 percent of the base amount is permitted and the restriction on tanning is raised from 90 to 100 percent. Printing ink plants also may use up to 100 percent of the base instead of the 70 percent formerly in effect.

The method of packaging chemicals is affected by an order of June 27 which prohibits use of tinplate or terneplate cans for many chemicals and paints. Among the products for which such cans may not be used are all paint and related products. Exception is made in the case of shellac, lacquers, varnish removers, lacquer thinners, and lacquer stains which may use terneplate but not tinplate. Under the prohibition come alcohol, cements including rubber, fly spray, lighter fluids, acetone, amyl acetate, oleic acid, sodium silicate, dry cleaners, turpentine, phenols and benzol, glycerine, dyes, graphite, liquid soap, glues and paste, waxes, and polish. After Oct. 31 the list will be broadened to include hard-

CHEM. & MET. Weight Index of CHEMICAL PRICES

Base = 100 for 1937

This month	**109.33**
Last month	109.39
July, 1941	101.17
July, 1940	98.60

Restrictions on industrial use have improved the supply of several chemicals and difficulty in making export shipments has brought out lower prices in resale transactions. Price schedules for nitrate of soda have been extended for the third quarter.

ened edible oils, hardened and unhardened lard, and edible liquid oils.

Official regulations likewise were important in influencing prices. Ceilings were removed in the case of synthetic rubber, aviation gasoline, toluol, and materials essential in their manufacture. Among the materials thus relieved from price control in the specified fields are butane and butylenes, aromatic hydrocarbons, iso-pentane and iso-butane, ethylene, propane, butadiene and styrene, hydrogen, acetaldehyde, acetylene, vinylacetylene, vinyl chloride, vinyl acetate, phthalate esters, tricresyl phosphate, hydrochloric acid, calcium carbide, ethylene dichloride, sodium polysulphide, butylene glycol, acrylonitrile, and toluol made from petroleum.

It has been officially ruled that gum naval stores are excepted from the general price regulation order but wood naval stores including pine oil remain under its provisions. Earlier in the period gum turpentine and rosin displayed a weak price tone with sales reported considerably below the level of the preceding month. Later, announcement was made that the Government was accumulating stocks and prices began to recover the lost ground. Exception of gum naval stores from price control is based on the decision that they are agricultural products.

Other price developments of the last month include permission granted to the Fluorspar Processing Co. in Colorado to sell its glass grade fluorspar at a maximum price of $27.40 a ton fob Salida, Colorado. This is the price previously authorized for the company's sales of the acid grade. The Western Feldspar Milling Co. has been granted authority to sell its 40 mesh fluorspar, 76 percent calcium fluoride, at a maximum price of $14.50 a ton fob Denver. Westvaco Chlorine Products Corp. is permitted to increase its price for maintenance grade deadburned magnesite to $40.50 a ton fob Patterson, Calif. This price to apply only to sales to the Vanadium Corp. of America and Mathieson Alkali Works. With this price in effect the producer will be able to supply the two consuming companies without jeopardizing its shipments to California steel mills.

CHEM. & MET.

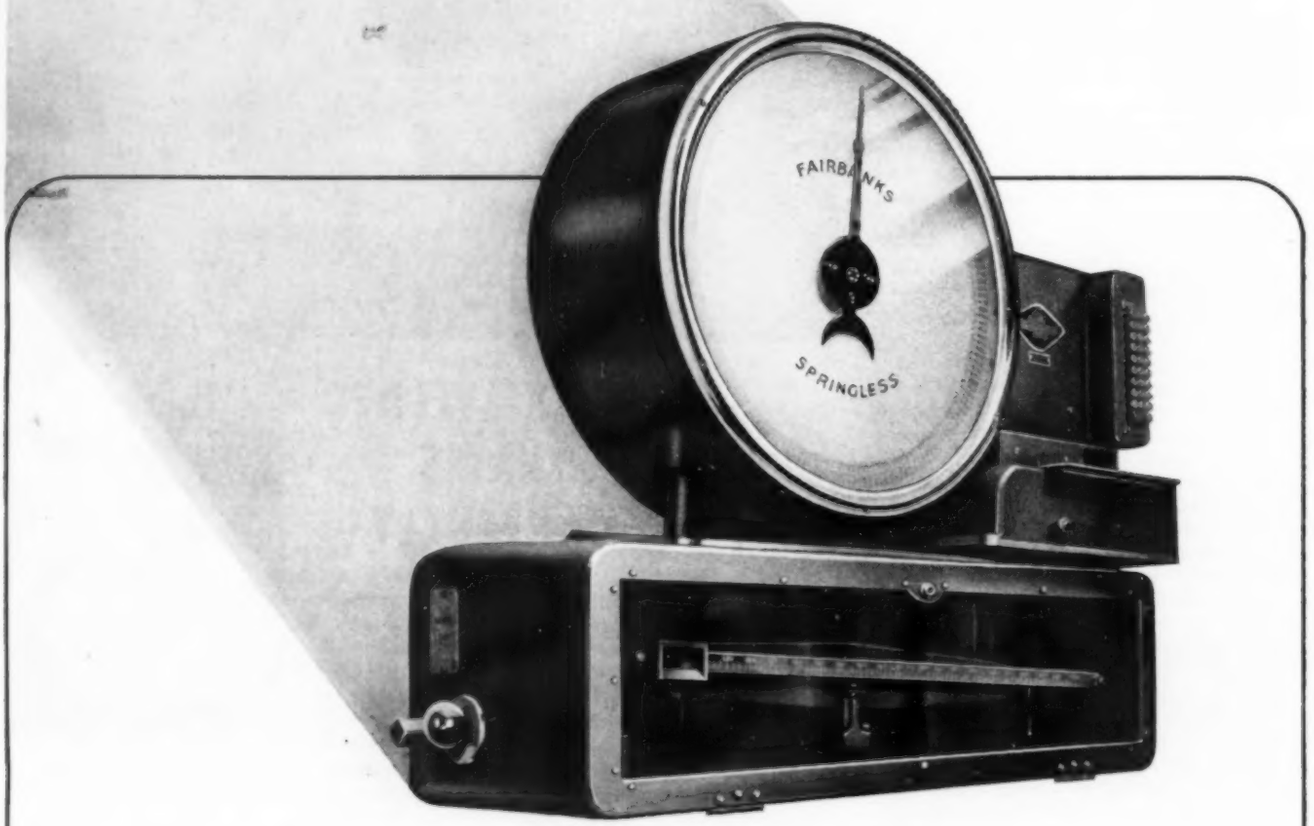
Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	143.22
Last month	143.60
July, 1941	72.37
July, 1940	70.33

Prices for many oils are merely nominal but new buying interest has lessened and offerings of soybean oil were made at lower levels. Linseed oil is quiet with reports from flaxseed growing areas awaited as price factors. Argentine seed is now of less than usual importance.

THESE SCALES HELP UPSET THE AXIS TIMETABLE!



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FAIRBANKS-MORSE

SCALES
DIESELS
MOTORS
PUMPS

CHEM & MET CURRENT PRICES

INDUSTRIAL CHEMICALS

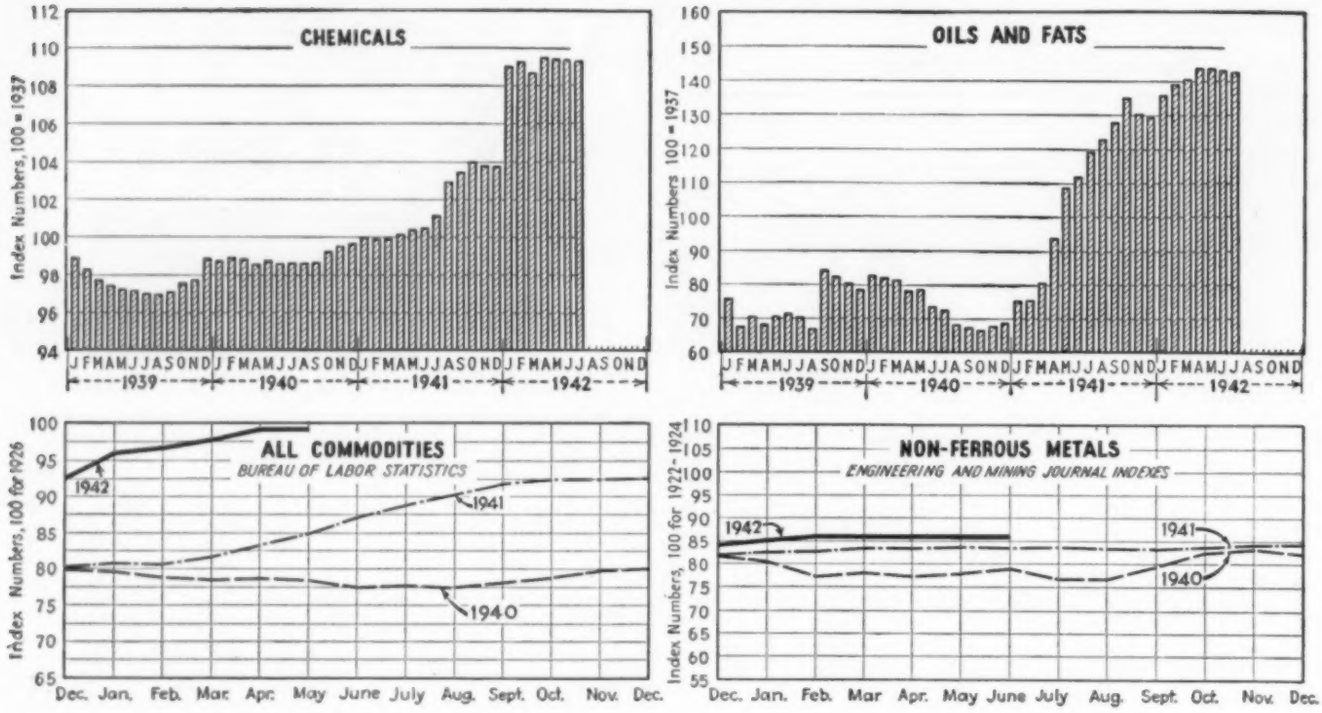
	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.168–$0.173	$0.168–$0.173	$0.08½–$0.09
Acid, acetic, 28%, bbl., cwt.	3.38 – 3.63	3.38 – 3.63	3.18 – 3.43
Glacial 99.5%, drums	9.15 – 9.40	9.15 – 9.40	8.43 – 8.68
U. S. P. X 1, 99.5%, dr	10.95 –11.20	10.95 –11.20	10.25 –10.50
Boric, bbl., ton	108.00–113.00	108.00–113.00	106.00–111.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys., lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb	1.10 – 1.15	1.10 – 1.15	1.05 – 1.15
Hydrofluoric 30% drums, lb	.08 – .08½	.08 – .08½	.08 – .08½
Lactic, 44%, tech., light, bbl., lb.	.073– .075	.073– .075	.06½– .06½
Muriatic 18°, tanks, cwt	1.05 –	1.05 –	1.05 –
Nitric, 36°, carboys, lb	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –	18.50 –20.00
Oxalic, crystals, bbl., lb	.11½– .13	.11½– .13	.10½– .12
Phosphoric, tech., c'bys., lb.	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –	13.00 –	13.00 –
Sulphuric, 66°, tanks, ton	16.50 –	16.50 –	16.50 –
Tannic, tech., bbl., lb	.71 – .73	.71 – .73	.64 – .66
Tartaric, powd., bbl., lb	.70 –	.70 –	.63 –
Tungstic, bbl., lb	nom	nom	nom
Alcohol, amyl	–	–	–
From Pentane, tanks, lb	.131–	.131–	.121–
Alcohol, Butyl, tanks, lb	.158–	.158–	.10 –
Alcohol, Ethyl, 190 p'f., bbl., gal.	8.19 – 8.25	8.19 – 8.25	6.04 –
Denatured, 190 proof	–	–	–
No. 1 special, dr., gal. wks.	.60 –	.60 –	.33 –
Alum, ammonia, lump, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Potash, lump, bbl., lb.	.04 – .04½	.04 – .04½	.03½– .04
Aluminum sulphate, com. bags, cwt.	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt	1.85 – 2.10	1.85 – 2.10	1.85 – 2.10
Aqua ammonia, 26°, drums, lb.	.02½– .03	.02½– .03	.02½– .03
tanks, lb.	.02 – .02¾	.02 – .02¾	.02 – .02¾
Ammonia, anhydrous, cyl., lb.	.16 –	.16 –	.16 –
tanks, lb.	.04½–	.04½–	.04½–
Ammonium carbonate, powd. tech., casks, lb.	.09½– .12	.09½– .12	.09 – .12
Sulphate, wks., cwt.	1.45 –	1.45 –	1.45 –
Amylacetate tech., from pentane, tanks, lb	.145–	.145–	.115–
Antimony Oxide, bbl., lb	.15 –	.15 –	.12 –
Arsenic, white, powd., bbl., lb.	.04 – .04½	.04 – .04½	.03½– .04
Red, powd., kegs, lb	nom	nom	nom
Barium carbonate, bbl., ton	60.00 –65.00	60.00 –65.00	55.00 –60.00
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb	.11 – .12	.11 – .12	.09½– .10
Blanc fix, dry, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt	2.25 – 2.35	2.25 – 2.35	2.00 – 2.10
Borax, gran., bags, ton	44.00 –	44.00 –	43.00 –
Bromine, cs., lb	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	3.00 –	3.00 –	3.00 –
Arsenate, dr., lb	.07 – .08	.07 – .08	.06½– .06¾
Carbide drums, lb	.04½– .05	.04½– .05	.04½– .05
Chloride, fused, dr., del., ton	18.00 –24.00	18.00 –24.00	19.00 –24.50
flake, bags., del., ton	18.50 –25.00	18.50 –25.00	20.50 –25.00
Phosphate, bbl., lb	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb	.05½–	.05½–	.05 –
Tetrachloride drums, gal	.73 – .80	.73 – .80	.66½– .73
Chlorine, liquid, tanks, wks., 100 lb.	2.00 –	2.00 –	1.75 –
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f.o.b., wks., ton	18.00 –19.00	18.00 –19.00	18.00 –19.00
Copper carbonate, bbl., lb	.18 – .20	.18 – .20	.10 – .16
Sulphate, bbl., cwt	5.15 – 5.40	5.15 – 5.40	4.75 – 5.00
Cream of tartar, bbl., lb	.57 –	.57 –	.52 –
Diethylene glycol, dr., lb	.14 – .15½	.14 – .15½	.22 – .23
Epsom salt, dom., tech., bbl., cwt.	1.90 – 2.00	1.90 – 2.00	1.80 – 2.00
Ethyl acetate, drums, lb	.12 –	.12 –	.08½–
Formaldehyde, 40%, bbl., lb	.05½– .06	.05½– .06½	.05½– .06
Furfural, tanks, lb	.09 –	.09 –	.09 –
Fusel oil, drums, lb	.18 – .19	.18 – .19	.17½– .19
Glaubers salt, bags, cwt	1.05 – 1.10	1.05 – 1.10	1.05 – 1.10
Glycerine, c.p., drums, extra, lb.	.18¼–	.18¼–	.14½–
Lead:			
White, basic carbonate, dry casks, lb	.08¼–	.08¼–	.07¼–
White, basic sulphate, sck., lb.	.07½–	.07½–	.07½–
Red, dry, sck., lb	.09½– .09¾	.09½–	.0835–
Lead acetate, white crys., bbl., lb.	.12¼– .13	.12¼– .13	.12 – .13
Lead arsenate, powd., bag, lb	.11 – .12	.11 – .12	.09½– .11
Lime, chem., bulk, ton	8.50 –	8.50 –	8.50 –
Litharge, powd., csk., lb	.08½–	.08½–	.0735–
Lithopone, bags, lb	.04½– .04¾	.04½– .04¾	.038– .04
Magnesium carb., tech., bags, lb.	.06¼– .06½	.06¼– .06½	.06½– .06½
Methanol, 95%, tanks, gal	.60 –	.60 –	.38 –
97%, tanks, gal	.60 –	.60 –	.39 –
Synthetic, tanks, gal	.28 –	.28 –	.30 –
Nickel salt, double, bbl., lb	.13½– .13¾	.13½– .13¾	.13½–
Orange mineral, csk., lb	.12½–	.12½–	.11½–
Phosphorus, red, cases, lb	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb.	.09½– .10	.09½– .10	.09½– .10
Carbonate, 80–85%, calc. csk., lb.	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb	.10 – .12	.10 – .12	.10 – .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07¼	.07 – .07¼	.07 – .07½
Muriate, 60% bags, unit	.53½–	.53½–	.53½–
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb	.19½– .20	.19½– .20	.19½– .20
Prussiate, yellow, casks, lb	.17 – .18	.17 – .18	.17 – .18
Sal ammoniac, white, casks, lb.	.0515– .06	.0515– .06	.0515– .06
Salsoda, bbl., cwt	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	17.00 –	17.00 –	17.00 –
Soda ash, light, 58%, bags, contract, cwt	1.05 –	1.05 –	1.05 –
Dense, bags, cwt	1.10 –	1.10 –	1.10 –
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, del., bbl., lb	.05 – .06	.04½– .06	.04 – .05
Bicarbonate, bbl., cwt	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb	.07½– .08	.07½– .08	.07½– .08
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	16.00 –17.00
Bisulphite, bbl., lb	.03 – .04	.03 – .04	.03 – .04
Chlorate, kegs, lb	.06½– .06½	.06½– .06½	.06½– .06½
Cyanide, cases, dom., lb	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb	.08 – .09	.08 – .09	.07 – .08
Hyposulphite, bbl., cwt	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt	2.50 – 2.65	2.50 – 2.65	2.35 – 2.40
Nitrate, bulk, cwt	1.35 –	1.35 –	1.45 –
Nitrite, casks, lb	.06½– .07	.06½– .07	.06½– .07
Phosphate, tribasic, bags, lb.	2.70 –	2.70 –	2.35 –
Prussiate, yel. drums, lb	.10½– .11	.10½– .11	.10½– .11
Silicate (40° dr.), wks., cwt	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr. lb.	.03 – .03½	.03 – .03½	.03 – .03½
Sulphite, crys., bbl., lb	.02½– .02¾	.02½– .02¾	.02½– .02¾
Sulphur, crude at mine, bulk, ton.	16.00 –	16.00 –	16.00 –
Chloride, dr., lb	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb	.07 – .08	.07 – .08	.07 – .07½
Flour, bag, cwt	1.90 – 2.40	1.90 – 2.40	1.60 – 3.00
Tin Oxide, bbl., lb	.55 –	.55 –	.55 –
Crystals, bbl., lb	.39½–	.39½–	.39½–
Zinc, chloride, gran., bbl., lb	.05½– .06	.05 – .06	.05 – .06
Carbonate, bbl., lb	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb	.10½–	.09½–	.09½–
Zinc oxide, lead free, bag, lb.	.07½–	.07½–	.06½–
5% leaded, bags, lb	.07½–	.07½–	.06½–
Sulphate, bbl., cwt	3.85 – 4.00	3.85 – 4.00	3.15 – 3.25

OILS AND FATS

	Current Price	Last Month	Last Year
Castor oil, 3 bbl., lb	$0.13¾–$0.14¼	$0.13¾–$0.14½	$0.11 –$0.11¼
Chinawood oil, bbl., lb	.38 –	.38 –	.32 –
Coconut oil, Ceylon, tank, N. Y., lb	nom	nom	.07 –
Corn oil crude, tanks (f.o.b. mill), lb	.12½–	.12½–	.12 –
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12½–	.12½–	.10½–
Linseed oil, raw car lots, bbl., lb.	.139–	.139–	.113–
Palm, casks, lb	.09 –	.09 –	.06½–
Peanut oil, crude, tanks (mill), lb.	.12¼–	.13 –	.12 –
Rapeseed oil, refined, bbl., lb	nom	nom	.15 –
Soya bean, tank, lb	.11½–	.11½–	.10 –
Sulphur (olive foots), bbl., lb	.19½–	.19½–	.16 –
Cod, Newfoundland, bbl., gal	nom	nom	nom
Menhaden, light pressed, bbl., lb.	.114–	.114–	.104–
Crude, tanks (f.o.b. factory) gal.	.66 –	.66 –	.60 –
Grease, yellow, loose, lb	.09295–	.09295–	.07½–
Oleo stearine, lb	.09½–	.09½–	.09½–
Oleo oil, No. 1	.11½–	.11½–	.10½–
Red oil, distilled, dp.p. bbl., lb.	.12 –	.12 –	.10½–
Tallow extra, loose, lb	.097125–	.097125–	.07½–

The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to July 13

Chem. & Met.'s Weighted Price Indexes



Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52– $0.55	$0.52 –$0.55	$0.52 –$0.55
Alpha-naphthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.15 – .16	.15 – .16	.15 – .16
Aniline, salts, bbl., lb.	.22 – .24	.22 – .24	.22 – .24
Benzaldehyde, U.S.P., dr., lb.	.85 – .95	.85 – .95	.85 – .95
Benzidine base, bbl., lb.	.70 – .75	.70 – .75	.70 – .75
Benzoic acid, U.S.P., kgs., lb.	.54 – .56	.54 – .56	.54 – .56
Benzyl chloride, tech., dr., lb.	.23 – .25	.23 – .25	.23 – .25
Benzol, 90%, tanks, works, gal.	.15 –	.15 –	.14 –
Beta-naphthol, tech., drums, lb.	.23 – .24	.23 – .24	.23 – .24
Cresol, U.S.P., dr., lb.	.11 –	.11 – .11	.09½– .10
Cresylic acid, dr., wks., gal.	.81 – .83	.81 – .83	.58 – .60
Diethylaniline, dr., lb.	.40 – .45	.40 – .45	.40 – .45
Dinitrophenol, bbl., lb.	.23 – .25	.23 – .25	.23 – .25
Dinitrotoluol, bbl., lb.	.18 – .19	.18 – .19	.15½– .16
Dip oil, 15%, dr., gal.	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, dr. f.o.b. wks., lb.	.60 –	.60 –	–
H-acid, bbl., lb.	.45 – .50	.45 – .55	.45 – .50
Naphthalene, flake, bbl., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Nitrobenzene, dr., lb.	.08 – .09	.08 – .09	.08 – .09
Para-nitraniline, bbl., lb.	.47 – .49	.47 – .49	.47 – .49
Phenol, U.S.P., drums, lb.	.13 –	.13 –	.12 –
Picric acid, bbl., lb.	.35 – .40	.35 – .40	.35 – .40
Pyridine, dr., gal.	1.70 – 1.80	1.70 – 1.80	1.70 – 1.80
Resorcinol, tech., kegs, lb.	.75 – .80	.75 – .80	.75 – .80
Salicylic acid, tech., bbl., lb.	.33 – .40	.33 – .40	.33 – .40
Solvent naptha, w.w., tanks, gal.	.27 –	.27 –	.27 –
Tolidine, bbl., lb.	.86 – .88	.86 – .88	.86 – .88
Toluol, drums, works, gal.	.33 –	.33 –	.30 –
Xylol, com., tanks, gal.	.26 –	.26 –	.26 –

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech, bbl., lb.	.15 – .17	.17 – .20	.21½– .22
China clay, dom., f.o.b. mine, ton.	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors			
Carbon gas, black (wks.), lb.	.0335– .30	.0335– .30	.0335– .30
Prussian blue, bbl., lb.	.36 – .37	.36 – .37	.36 – .37
Ultramarine blue, bbl., lb.	.11 – .26	.11 – .26	.11 – .26
Chrome green, bbl., lb.	.21½– .30	.21½– .30	.21½– .30
Carmine, red, tins, lb.	4.60 – 4.75	4.60 – 4.75	4.60 – 4.75
Para toner, lb.	.75 – .80	.75 – .80	.75 – .80
Vermilion, English, bbl., lb.	3.05 – 3.10	3.05 – 3.10	3.20 – 3.25
Chrome yellow, C.P., bbl., lb.	.14½– .15½	.14½– .15½	.14½– .15½
Feldspar, No. 1 (f.o.b.N.C.), ton.	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.08 – .10	.08 – .10	.08 – .10
Gum copal Congo, bags, lb.	.09 – .30	.09 – .30	.08 – .30
Manila, bags, lb.	.09 – .15	.09 – .14	.09 – .14
Demar, Batavia, cases, lb.	.10 – .22	.10 – .20	.10 – .22
Kauri, cases, lb.	.18 – .60	.18 – .60	.18½– .60
Kieselguhr (f.o.b. mines), ton.	7.00 –40.00	7.00 –40.00	7.00 –40.00
Magnesite, calc, ton	64.00 –	65.00 –	65.00 –
Pumice stone, lump, bbl., lb.	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb.	nom	nom	.03 – .04
Rosin, H., 100 lb.	3.73 –	3.33 –	2.62 –
Turpentine, gal.	.65½–	.67 –	.51½–
Shellac, orange, fine, bags, lb.	.39 –	.39 –	.38 –
Bleached, bonedry, bags, lb.	.39 –	.39 –	.35 –
T. N. Bags, lb.	.31 –	.31 –	.28 –
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc. 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
200 mesh (f.o.b. Ga.), ton.	6.00 – 8.00	6.00 – 8.00	7.50 –11.00

Industrial Notes

WESTVACO CHLORINE PRODUCTS CORP., New York, has integrated into the corporation, its Warner Chemical, California Chemical, National Kellastone, and Magnesol divisions. No changes in personnel or functions are involved.

GENERAL PRINTING INK CORP., New York, has consolidated all its branches making finishes and protective coatings into the General Industrial Finishes Division with John F. Devine as general manager.

THE UNITED STATES STONEWARE CO., New York, through its unit, Chamberlain Engineering, Ltd., has purchased the business and plant of the Lower Rubber Mfg. Co. at Ravenna, Ohio. Technical and sales facilities of the two companies will be merged with M. S. Lower serving as general manager of the plant.

COMMERCIAL SOLVENTS CORP., New York, has placed the supervision of its central and eastern divisions in the hands of H. B. Sliger. This action was taken because James V. O'Leary, manager of the central division is actively engaged as an officer in the Chemical Warfare Service.

ALLIS-CHALMERS, Milwaukee, has engaged Dr. Ellis E. Jensen as research assistant in its industrial relations department.

CHAIN BELT CO., Milwaukee, has appointed the Industrial Equipment Co., Oakland, Calif., as its distributor in the Bay area and the Sanford Tractor & Equipment Co., Reno, as distributor for Nevada.

H. A. BRASSERT & CO., New York, has entered into an exclusive license arrangement with S. P. Kinney, formerly vice-president of the company, covering the manufacture, sale and installation of all equipment formerly made by the Brassert organization.

ROBINS CONVEYING BELT CO., Passaic, N. J., has placed its office in Cleveland in charge of S. F. Knight who also will continue as manager of the Detroit office. Maurice S. Bradley, recently in charge at Cleveland is now in active service as Major in the Coast Artillery Corps.

KOPPERS CO., Pittsburgh, has absorbed its subsidiary, The White Tar Co., and the latter is now called Koppers Co. White Tar division. Operations will not be affected and R. C. Wickersham remains as local manager.

ACHESON COLLOIDS CORP., Port Huron, Mich., has added John M. Lupton to its staff. Mr. Lupton will have direction of the advertising and publicity departments.

ALLEGHENY LUDLUM STEEL CORP., Pittsburgh, has appointed H. N. Arbuthnot assistant sales manager. He is succeeded as manager of the Detroit office by J. D. McKnight.

Have you investigated these New Synthetic Organic Chemicals?

—*They are available in research quantities*

Chemical	Formula	Boiling Point °C. at 760 mm.	Suggested Uses
Acetoacet-o-toluidide	$CH_3COCH_2CONHC_6H_4CH_3$	(a)	Dyestuff intermediate
Benzyl "Cellosolve"	$C_6H_5CH_2OCH_2CH_2OH$	256	High-boiling solvent
Butyl "Cellosolve" Acetate	$C_4H_9OCH_2CH_2OCOCH_3$	192	Lacquer solvent
"Dehydranone" (Dehydracetic Acid)	$CH_3COCHCOCH{:}C(CH_3)OCO$	(b)	Camphor-like plasticizer
Dichlorethyl Formal	$CH_2(OCH_2CH_2Cl)_2$	218	Elastomer intermediate
Dichlorisopropyl Ether	$(ClCH_2(CH_3)CH)_2O$	187	Textile assistant
Diethyl "Cellosolve"	$C_2H_5OC_2H_4OC_2H_5$	121	Nitrocellulose solvent
Diglycol Diacetate	$(CH_3COOCH_2CH_2)_2O$	250	Printing ink solvent
Diisopropanolamine	$(CH_3CHOHCH_2)_2NH$	249	Emulsifying agent intermediate
Dimethyl Dioxane	$OCH(CH_3)CH_2OCH_2CH(CH_3)$	117	Solvent, extractant
Dimethylethanolamine	$(CH_3)_2NCH_2CH_2OH$	133	Emulsifying agent intermediate
N-Ethyl Morpholine	$CH_3CH_2NCH_2CH_2OCH_2CH_2$	138	Solvent, emulsifying agent
Glycol Diformate	$HCOOCH_2CH_2OCOH$	177	Solvent, embalming agent
Hexanol	$CH_3(CH_2)_4CH_2OH$	157	Drug intermediate, perfumes
Hexyl Ether	$C_6H_{13}OC_6H_{13}$	226	Defoamer, inert reaction medium
Isopropanolamine	$CH_3CH(OH)CH_2NH_2$	160	Emulsifying agent, intermediate
Methyl "Carbitol" Acetate	$CH_3COOC_2H_4OC_2H_4OCH_3$	209	Printing ink solvent
Methyl "Cellosolve" Acetal	$CH_3CH(OCH_2CH_2OCH_3)_2$	207	Source of nascent acetaldehyde
Methyldiethanolamine	$CH_3N(C_2H_4OH)_2$	247	Intermediate, emulsifying agent
4-Methyl Dioxolane	$CH_3CHOCH_2OCH_2$	85	Cellulose acetate solvent
N-Methyl Morpholine	$CH_2CH_2OCH_2CH_2NCH_3$	115	Emulsifying agent, intermediate
N-Phenyl Morpholine	$C_6H_5NCH_2CH_2OCH_2CH_2$	(c)	Dyestuff intermediate
Polyethylene Glycols	$HO(CH_2CH_2O)xH$	(d)	Solvents, plasticizers, alkyd resins
Sodium Acetoacetyl-p-sulfanilate	$CH_3COCH_2CONHC_6H_4SO_3Na$	(e)	Dyestuff intermediate
Tetraethanolammonium Hydroxide	$(HOCH_2CH_2)_4NOH$	(f)	Solvent, strong base
Trichlorethane	$ClCH_2CHCl_2$	113	Solvent, extractant
Triglycol Dichloride	$ClC_2H_4OC_2H_4OC_2H_4Cl$	241	Solvent, plasticizer, intermediate

(a) Melts at 106°C. (b) Melts at 108°C. (c) Melts at 52 to 56°C. (d) Non-volatile, hygroscopic (e) Aqueous solution (f) Melts at 123°C.

This is a summary of research chemicals **announced in our recent advertisements. Although in most cases, only research quantities of these chemicals are available now, it is possible that commercial quantities will be made in the future if important uses develop.**

For information concerning the use of these chemicals, address:

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC **New York, N. Y.**

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

CHEM & MET NEW CONSTRUCTION

	Current Projects		Cumulative 1942	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$40,000	$500,000	$2,590,000	$4,100,000
Middle Atlantic	125,000	1,390,000	6,846,000	57,956,000
South	.....	.....	9,345,000	42,583,000
Middle West	100,000	4,430,000	82,515,000	156,485,000
West of Mississippi	1,530,000	60,480,000	171,967,000	241,300,000
Far West	250,000	4,000,000	20,600,000	113,882,000
Canada	1,070,000	1,318,000	10,660,000	1,318,000
	$3,115,000	$72,118,000	$304,523,000	$617,624,000

PROPOSED WORK

Conn., Naugatuck—Naugatuck Chemical Co., Div. of U. S. Rubber Co., Naugatuck, is receiving bids for the construction of a factory building. Fletcher Thompson, Inc., 1336 Fairfield Ave., Bridgeport, Engr. Estimated cost will exceed $40,000.

Ind., Indianapolis—Piel Bros. Starch Co., 1515 Drover St., plans to rebuild its plant recently destroyed by fire. Estimated cost including equipment $100,000.

Ia., Clinton—Clinton Products Co. plans to construct an alcohol plant here. Estimated cost $50,000.

Neb., West Point—Northeast Nebraska Processing Corp., West Point, contemplates the construction of a plant for the manufacture of grain alcohol. Estimated cost $600,000.

N. Y., Lyons—Dry Pack Corp., Lyons, plans to construct three 1 story, 25x35 ft., 24x40 ft. and 28x36 ft. additions to its plant on Canal St. Estimated cost $45,000.

Pa., Kane—Speer Carbon Co., St. Marys, has taken over the plant formerly occupied by Albertson Co. and plans to alter, improve and construct additions to same. Estimated cost including equipment $40,000.

Pa., Muscatine—Publicker Industrial Alcohol Corp., 1800 West Lexington Ave., Philadelphia, Pa., plans to construct a corn alcohol manufacturing plant.

Tex., Borger—Phillips Petroleum Co., Borger, plans the construction of storage facilities. Estimated cost $80,000.

Tex., Denison—Bell Oil & Gas Co., and Ben Franklin Refining Co., Denison, will soon receive bids for the construction of a refinery. Estimated cost $800,000.

Wash., Spokane—Washington Refining Co., c/o B. H. Kiser, Old National Bank Bldg., plans improvements and warehouse to plant on Green St. Estimated cost $250,000.

B. C., Vancouver—Coal Carbonizing Co., 418 Olive St., St. Louis, Mo., plans to construct a plant here for the manufacture of carbonaceous products. Estimated cost $50,000.

B. C., Victoria—Alliance Oils, Ltd., 1 Central Bldg., Calgary, Alta., plans to construct an oil recovery plant. Estimated cost $50,000.

N. B., St. John—McColl Frontenac Oil Co., Ltd., 360 West St. James St., Montreal, Que., plans to construct an addition to its plant. Estimated cost $65,000.

Ont., Chatham—Board of Trade, Chatham, plans the construction of a soy bean processing plant. Estimated cost $40,000.

Ont., Elmira—Naugatuck Chemical Co., Elmira, will soon receive bids for the construction of a new plant and equipment. Estimated cost $130,000.

Ont., Kapuskasing—Spruce Falls Power & Paper Co., Ltd., Kapuskasing, plans to complete its pulp and paper plant. Estimated cost $575,000.

Ont., St. Thomas—St. Thomas Paper Tubes, Ltd., St. Thomas, Ont., plans to construct a factory. Estimated cost $40,000.

Que., Gatineau—International Fibre Board, Ltd., Sun Life Bldg., Montreal, Que., plans to construct an addition to its plant.

Que., St. Jean—Canadian Potteries, Ltd., 7 MacKenzie King Ave., plans to construct an addition to its plant. Archibald & Illsley, 1440 West St. Catherine St., Montreal, Archt.

Que., Valleyfield—Quebec Distillers, Ltd., 680 West Sherbrooke St., Montreal, plans to construct an addition to its plant. Estimated cost $40,000.

CONTRACTS AWARDED

Calif., San Pedro—Union Oil Co., Union Oil Bldg., has awarded the contract for the construction of a refinery to Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost $4,000,000.

D. C., Washington—U. S. War Dept. has awarded the contract for the construction of a chemical manufacturing plant to Kershaw-Butler & Engineers, Ltd., Huntsville, Ala. Estimated cost $1,000,000.

Ill., Chicago—American Phenolic Corp., 1830 South 54th St., Cicero, has awarded the contract for 100x266 ft. top addition and alterations to warehouse, also 1 story, 80x310 ft. warehouse to Campbell-Lowrie-Lautermilch Corp., 400 West Madison St., Chicago. Estimated cost will exceed $100,000.

Mass., Hanover—American Fireworks Co., Massachusetts Turnpike, Randolph, has awarded the contract for the construction of a 2 story plant to C. C. Fulton & Son, Inc., 8 Francis St., Milton. Estimated cost $500,000.

Michigan—Headquarters of the Reichbald Chemical Co., Inc., Ferndale, has awarded the contract for the construction of a plant to Cunningham-Rudy Co., 3087 West Grand Blvd., Detroit. Estimated cost $1,250,000.

N. J., Newark—American Aviation Oil Co., 225 Broadway, New York, N. Y., will construct refinery buildings. Work will be done by separate contracts. Estimated cost $100,000.

N. J., Newark—Couse Laboratories, Inc., 300 Passaic Ave., has awarded the contract for the construction of a 2 story, 110-240 ft. plant to Edward M. Waldron, Inc., 40 Park Pl. Estimated cost $250,000.

N. J., Secaucus—New Jersey Soap Works, 1200 Palisade Ave., Union City, has awarded the contract for the construction of a 2 story, 32x74 ft. factory to Manzo & Son, Demarest Ave., Hillsdale. Estimated cost will exceed $40,000.

Ohio—Ferro Enamel Corp., Robert Weaver, Pres., 4150 East 56th St., Cleveland, has awarded the contract for the construction of a plant to Alger-Rau, Inc., 12434 Cedar Rd., Cleveland. Estimated cost $3,000,000.

O., Chillicothe—National Fireworks Corp., G. J. Clarke, Pres., West Hanover, Mass., has awarded the contract for the construction of a plant to Foundation Co., 120 Liberty St., New York City. Estimated cost will exceed $40,000.

O., Cleveland—National Bronze & Aluminum Co., J. L. Schmeller, Pres., 8800 Lalsy Ave., has awarded the contract for the construction of a 1 story, 66x87 ft. addition to its plant to H. L. Vokes Co., 5300 Chester Ave. Estimated cost $40,000.

Texas—Abercrombie Oil Co., Sweeney, has awarded the contract for the construction of a refinery to Paul Wood. Estimated cost $2,000,000.

Texas—Constal Recycling Corp., Corpus Christi, has awarded the contract for the construction of a plant to Arthur G. McKee & Co., 2300 Chester St., Cleveland, O. Estimated cost $1,500,000.

Texas—Goodrich Rubber Co., Akron, O., has awarded the contract for the construction of a plant to George A. Fuller Co., 597 Madison Ave., New York, N. Y. Estimated cost $8,000,000.

Texas—Goodyear Tire & Rubber Co., Akron, O., and Sinclair Refining Co., Houston, have awarded the contract for the construction of a plant to Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost $38,000,000.

Texas—Goodyear Tire & Rubber Co., Akron, O., has awarded the contract for the construction of a plant to George A. Fuller Co., 597 Madison Ave., New York, N. Y. Estimated cost $9,000,000.

Texas—Gulf Plains Corp., Corpus Christi, has awarded the contract for the construction of a plant to Arthur G. McKee & Co., 2300 Chester St., Cleveland, O. Estimated cost $1,200,000.

Texas—Lockhart Oil Co. of Texas, Corpus Christi, has awarded the contract for the construction of a plant to Arthur G. McKee & Co., Cleveland, O. Estimated cost $780,000.

Que., Kilmar—Canadian Refractories, Ltd., 606 Cathcart St., Montreal, will remodel its kiln plant. Work will be done by day labor. Estimated cost $75,000.

Que., Shawinigan Falls—Canadian Carborundum Co., Ltd., Transmission St., has awarded the contract for the construction of plant buildings to J. F. Wickenden, Bank of Montreal Bldg., Three Rivers. Estimated cost $243,000.

Ont., Toronto—Dow Chemical Co. of Canada, Ltd., 159 Bay St., has awarded the contract for the construction of plant buildings to Anglin-Norcross Ontario, Ltd., 57 Bloor St., W., Toronto, and Pigott Construction Co., Ltd., Pigott Bldg., Hamilton. Estimated cost $1,000,000.